



**LMS 200 / LMS 211 /
LMS 220 / LMS 221 / LMS 291
Laser Measurement Systems**

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1 Range of applications

LMS 200, LMS 220, LMS 211, LMS 221, LMS 291 Laser Measurement Systems

- Determining the volumes or contours of bulk materials
- Determining the volumes of objects (measuring packages, pallets, containers)
- Determining the position of objects (pallets, containers, transport vessels)
- Collision prevention for vehicles or cranes
- Controlling docking processes (positioning)
- Classification of objects (vehicle detection, camera trigger)
- Process automation (e.g. calender rollers)
- Checking overhang/area monitoring in automated multi-storey car parks
- Monitoring open spaces for building security (facades, grounds, shafts)
- and many more

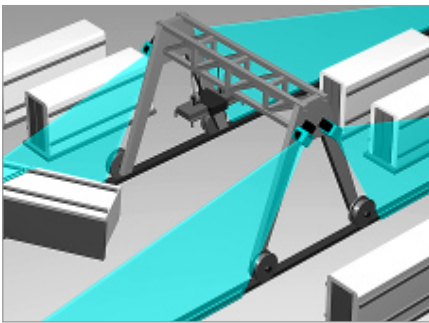


Fig. 1-1: Collision prevention on container cranes

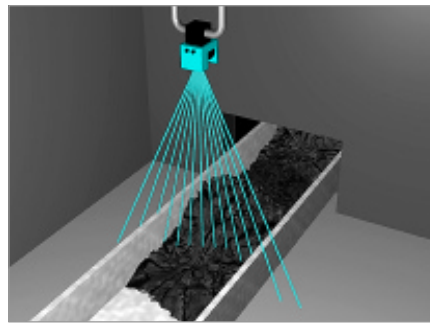


Fig. 1-2: Measuring bulk materials on conveyor belts or in bunkers

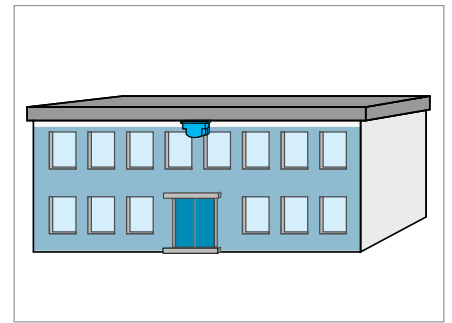


Fig. 1-3: Monitoring open spaces for building security



Fig. 1-4: Collision prevention



Fig. 1-5: Collision prevention at the harbour

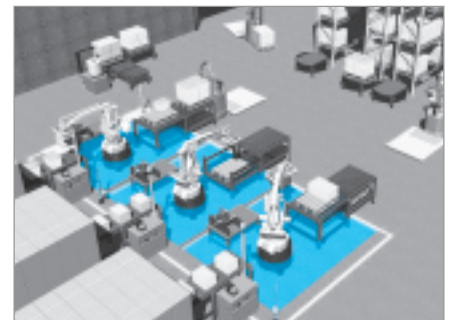


Fig. 1-6: Detection of objects

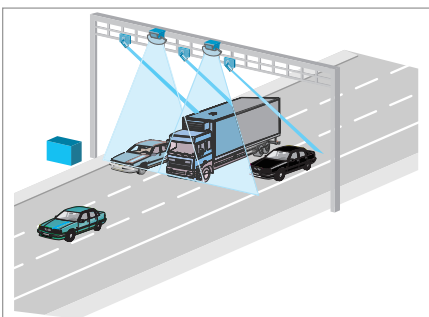


Fig. 1-7: Classification of vehicles



Fig. 1-8: Your application

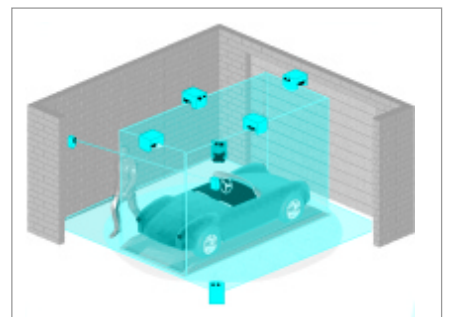


Fig. 1-9: Checking overhang in automated multi-storey car parks

2 Product features

LMS 2.. laser scanners are non-contact measurement systems (NCSDs), that scan their surroundings two-dimensionally (laser radio). As scanning systems the devices require neither reflectors nor position marks.

The systems are used for:

- area monitoring
- object measurement and detection
- determining positions

Defined monitored fields can be programmed in the scanner for the area monitoring application. Each monitored field is assigned a 24 V switching output.

The LMI interface module is available as an optional extension to the system. It can administer several scanners and provides the corresponding 24 V switching outputs.

Standard solutions are available for *object measurement*, e.g. measuring the volumes of packages and pallets; volume flow measurement for bulk materials; etc.

The scanner's measurement data can be individually processed in real time with external evaluation software for *determining positions* and other measurement tasks.

Maintenance and care

The LMS scanner requires no maintenance, though depending on its location the scanner's front window should be cleaned occasionally.

Please note:

Never open the laser scanner yourself! The producer warranty will be forfeited if the scanner is opened.

Erroneous functions can be clarified by means of the LMS/LMI User Software error diagnosis. The SICK Service team is available for handling more serious errors. Errors caused by a contaminated front window are indicated via the built-in LEDs (see Table 8-1).



Please note:

LMS laser scanners are not devices for protecting persons as defined by current machine safety standards.

Features and advantages

- Non-contact optical measurement, even over longer distances
- Rapid scanning times, thus measurement objects can move at high speeds
- No special target-object reflective properties necessary
- No reflectors and no marking of the measurement objects necessary
- Backgrounds and surroundings do not have any influence on the measurements
- Measurement objects may be in any position
- Measurement data is available in real time and can be used for further processing or control tasks
- Active system – no illumination of the measurement area required
- Simple mounting and commissioning
- Completely weatherproof variants



Fig. 2-1: LMS 200



Fig. 2-2: LMS 220

See also
12 Overview of
LMS variants



Fig. 2-3: LMS 291



Fig. 2-4: LMS 221



Fig. 2-5: LMS 211

3 Operating principle

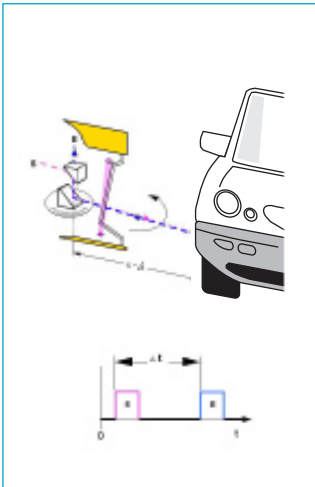


Fig. 3-1: Operating principle

The LMS system operates by measuring the time of flight of laser light pulses: a pulsed laser beam is emitted and reflected if it meets an object. The reflection is registered by the scanner's receiver. The time between transmission and reception of the impulse is directly proportional to the distance between the scanner and the object (time of flight).

The pulsed laser beam is deflected by an internal rotating mirror so that a fan-shaped scan is made of the surrounding area (laser radar). The contour of the target object is determined from the sequence of impulses received. The measurement data is available in real time for further evaluation via a serial interface.

Automatic fog correction is active in the scanner for outdoor use. Raindrops and snowflakes are cut out using pixel-oriented evaluation.

Spot spacing/spot diameter/range

In a radial field of vision, a light impulse (spot) is emitted every 0.25° , 0.5° or 1° (depending on the variant).

As a result of the beam geometry and the diameter of the individual spots, the spots overlap on the target object or up to a certain distance. Fig. 3-2 shows spot spacing in relation to the range and the corresponding spot diameter.

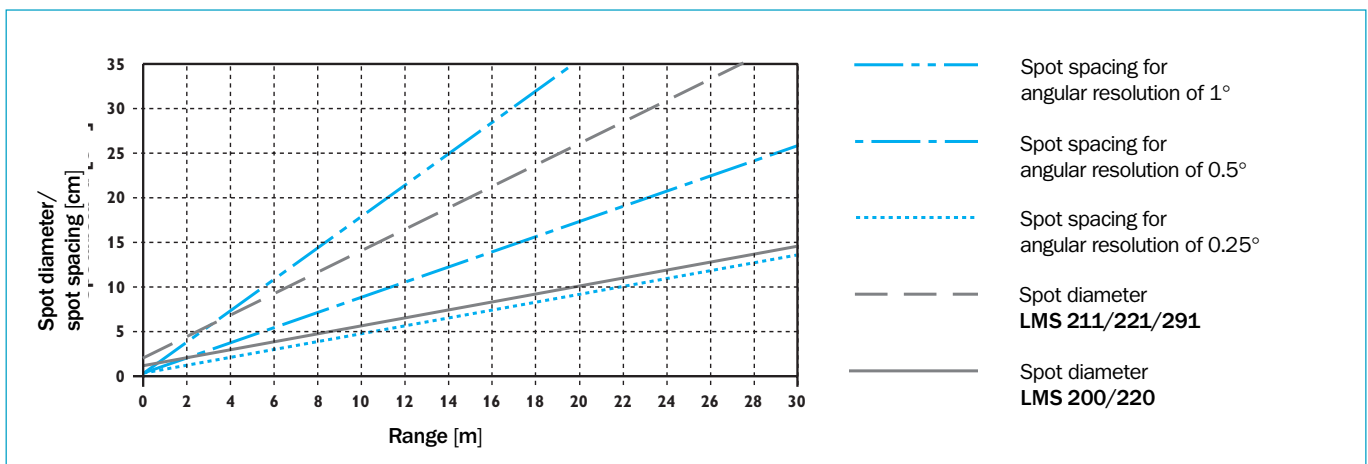


Fig. 3-2: Spot sizes/spot spacing

4 Conditions of use/range

4.1 Mounting location

The scanner may be installed in any position. The mounting instructions in *Chapter 6* are to be observed.

4.2 Heater operation (LMS 220 and LMS 211/LMS 221)

In order to be able to use the LMS at temperature ranges below 0° C, a thermostat-controlled heater has been installed in these scanners and supplementary front window heating in the LMS 211. The heating comes into operation at $\leq 10^{\circ}\text{C}$ order to prevent thawing within the housing.

Before commissioning the LMS (e.g. before starting work) the interior of the scanner must be heated to at least 0° C and any ice on the front window must be melted.

The scanner takes approx. 120 min. to heat up at an outdoor temperature of -30°C .

4.3 Reflectivity of various objects

The range of the scanner depends on the reflectivity of the target object and the transmission strength of the scanner. Some reflectivity values for well-known materials have been included below as an overview (KODAK standards).

LMS with standard range without fog correction:

LMS 200-30106
LMS 220-30106
LMS 211-S09

LMS with high range and fog correction:

LMS 211-30206
LMS 211-S07
LMS 221-30206
LMS 221-S07
LMS 291-S05

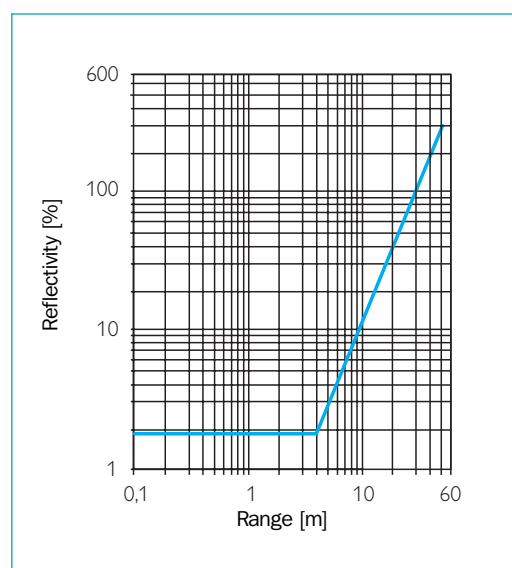


Fig. 4-1: LMS 200/LMS 220
Range in relation to object reflectivity

Material	Reflectivity
Cardboard, matt black	10%
Cardboard, grey	20%
Wood (raw pine, dirty)	40%
PVC, grey	50%
Paper, matt white	80%
Aluminium, anodised, black	110...150%
Steel, rust-free shiny	120...150%
Steel, very shiny	140...200%
Reflectors	> 2000%

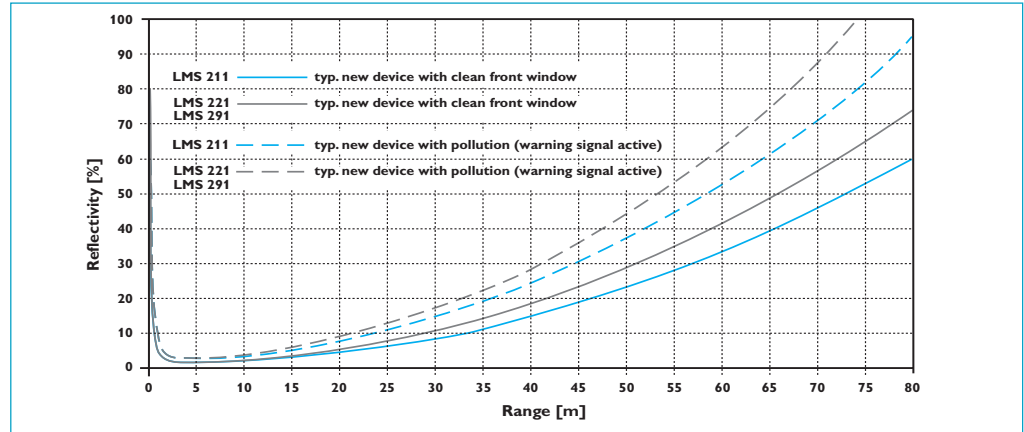


Fig. 4-2: LMS 211, LMS 221, LMS 291, relationship between reflectivity and range with good visibility

In exceptional cases, sensitivity can be changed with the user software provided:

- values for **standard setting** (see diagram): 30 m range/10% reflectivity
- values for less sensitive thresholds: 25 m range/10% reflectivity
- values for more sensitive thresholds: 30 m range/5% reflectivity

Please note:

Higher sensitivity improves detection capabilities for dark objects, but increases ambient light sensitivity.

Lower sensitivity reduces detection capabilities for dark objects, but reduces ambient light sensitivity.

4.4 Reflectivity in fog (LMS 211-30206/LMS 221-30206/LMS 291-S05)

Fig. 4-3 to Fig. 4-6 are valid should there be fog during outdoor operation and are to be observed.

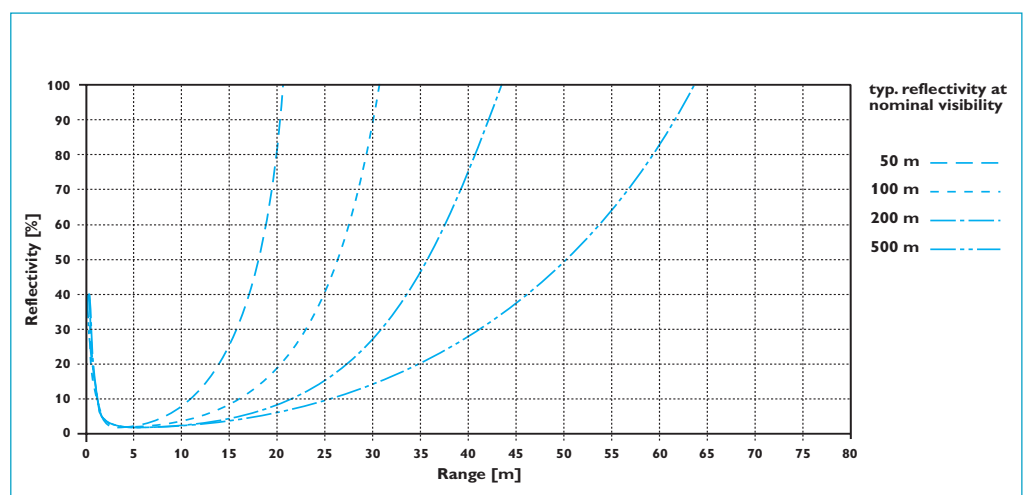


Fig. 4-3: LMS 211 – relationship between reflectivity and range in fog

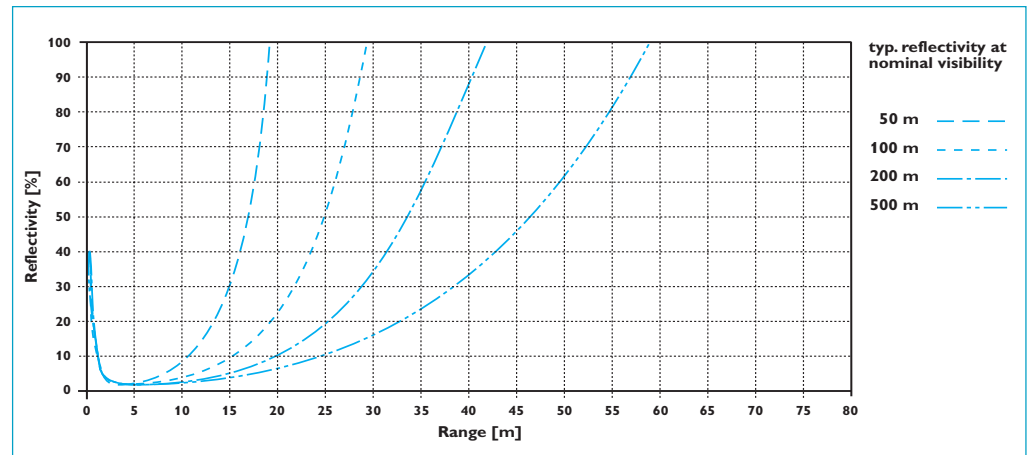


Fig. 4-4: LMS 221/LMS 291 – relationship between reflectivity and range in fog

4.5 The „blanking“ curve (LMS Outdoor and LMI 400)

The object suppression software setting is dependent on distance. An object can only be suppressed up to a certain distance. Furthermore, the scanner switches independently of object size.

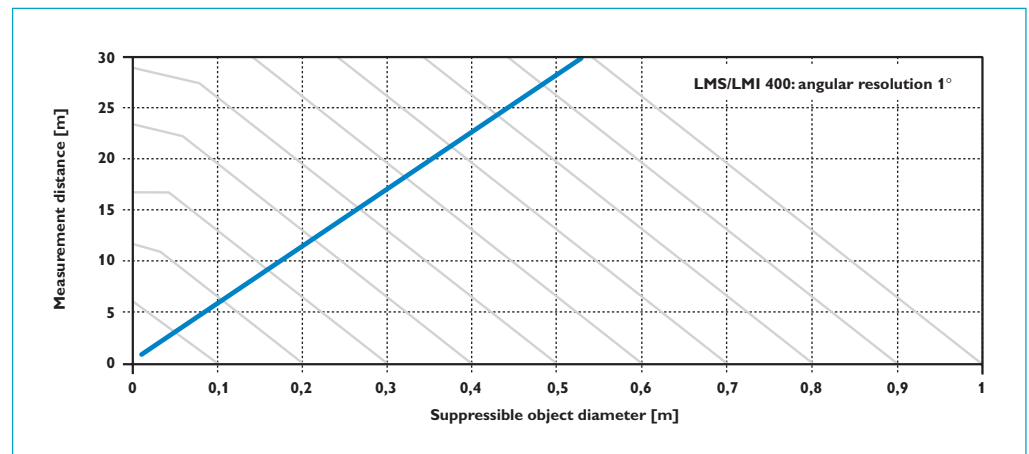


Fig. 4-5: Relationship between the usable range and the defined blanking diameter

4.6 The „contour as reference“ curve

The contour as reference software setting is dependent on distance. The scanner requires a minimum contour as reference depending on the distance. Loss of the contour will not be switched at the switching output if the contour is too small.

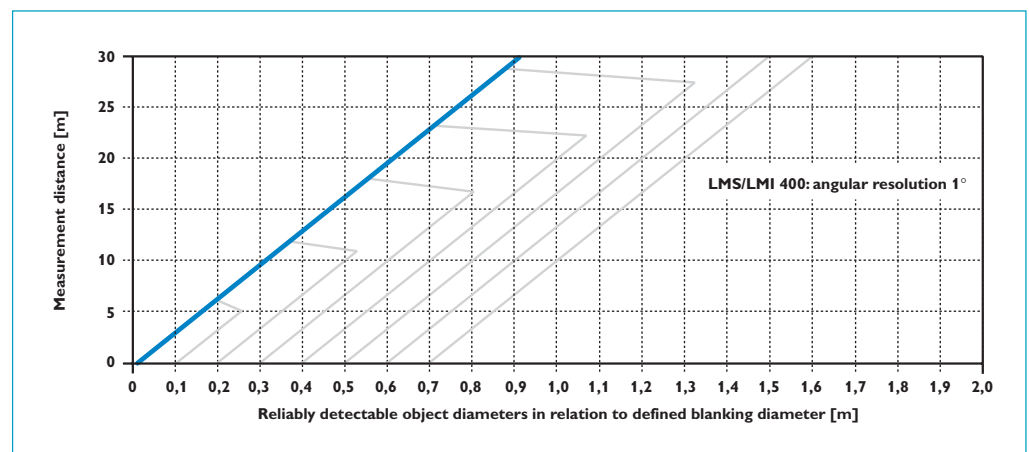


Fig. 4-6: Relationship between the usable range and reliably detected object diameter

5 Areas of use

One distinguishes between three areas of use:

- object measurement
- determining position
- area monitoring

5.1 Object measurement/determining position

Laser scanner measurement data is used for object measurement and determining position. These measurement data correspond to the surrounding contour scanned by the device and are given out in binary format via the RS 232/RS 422 interface.

The telegram listing required is supplied with the device.

Our MST Measurement Software Tool provides further support for software connections to the LMS laser scanner (please see separate Technical Description, order no. 8008464).

Processing measurement data

Processing measurement data allows individual adaptation to the system's particular measurement task.

Possible data preparation within the LMS:

- Average value formation from 2 - 250 scans
- Limiting the sector from which values are transferred (e.g. beams 10 - 30) for data reduction

Possible external data processing:

- Evaluation of partial sectors of the 100° or 180° field of view
- Averaging of the measurement values transferred (increasing accuracy and smoothness)
- Straight line and curve approximations by interpolation of measurement values
- Determination of position/volume of any objects
- 3rd dimension provided by shaft encoder, etc. (length information/speed of transport)

External evaluation (software) can take place at a PC or SPC.

Fundamentally, the distance value per individual impulse (spot) is evaluated. This means that a distance value is provided every 0.25°, 0.5° or 1°, depending on the angular resolution of the scanner.

Angular resolution	0.25°	0.25°	0.5°	1°
max. scanning angle *)	100°/180°	180°	100°/180°	100°/180°
max. no of measured values	401	721	361	181
		4x1°-values, interlaced		

*)symmetrical, from the middle

Angular resolution is set using a software telegram.

As the individual values are given out in sequence (beginning with value 1), particular angular positions can be allocated on the basis of the values' positions in the data string. Note that the LMS turns towards the left (see Figs. 5-1 and 5.2).

In its default state the scanner is set to the "Measured values on request" mode and "Transfer rate 9,600 baud" (changes can be made using the appropriate telegram commands).

It is recommended that the scanner is operated in the "9,600 baud on Power-on" mode (default setting). Conversion to a different baud rate can take place after the complete system has been started up.

5.2 Area monitoring/Detection

Here, the system is responsible for automatically reporting that an area „is free“. This means that an infringement of a field, e.g. by an object or machine part, leads to a switching signal at an output.

Pixel-oriented evaluation/object blanking

Pixel-oriented evaluation is used for suppressing raindrops and snowflakes or other particles, and thus makes the system less sensitive to environmental factors. This involves saving the sequential messages (measured values) from each individual spot in each scan, and a separate counter being started for each spot. Erroneous measurements can be filtered out by repeatedly examining the reported spot (multiple scanning whose number depends on the setting selected).

Pixel-oriented evaluation should be included in the corresponding evaluation software when external data processing is undertaken.

Object blanking is used for suppressing an object that is not to be detected, e.g. a steel cable, that is located within the monitored field.

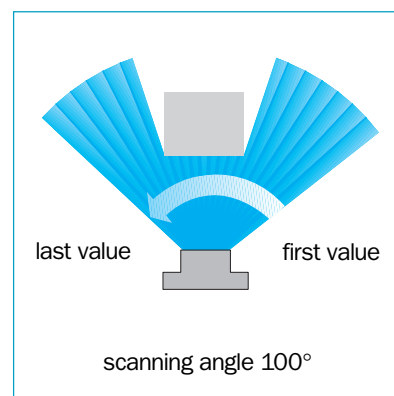


Fig. 5-1: Direction of transmission for LMS 211 scanners

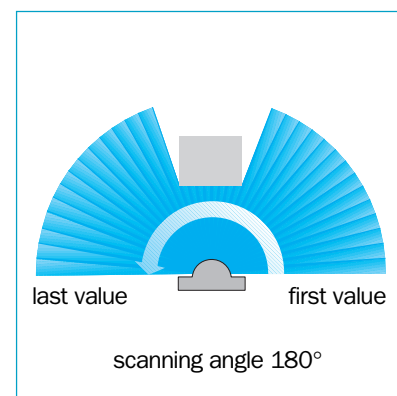


Fig.5-2: Direction of transmission for LMS 200, LMS 220, LMS 221, LMS 291 scanners

6 Mounting

Mounting sets (see *Fig. 6-1*) are available for easy installation. They allow adjustment of devices in both axes, as shown.

The scanner can be installed in any position, though direct sunlight on the front window is to be avoided (to prevent dazzle).

Outdoor variants should generally be mounted in such a way that the connection plug is located on the lower right-hand side of the back plate in order not to affect pollution measurement (exit window).

Outdoor installation:

An appropriate sunshade is to be provided to prevent direct sunlight falling on the scanner housing (sheet metal, etc, see *Fig. 6-2*). Threaded holes are provided on the rear of the scanner for attachment (LMS 211/221/220). A dust prevention shield is recommended for preventing dust and/or condensation on the front window (see LMS 211). Purging air can be used if dust is present in large quantities. The cap of the optional connection socket (motor flap) must be screwed in (to maintain the enclosure rating).

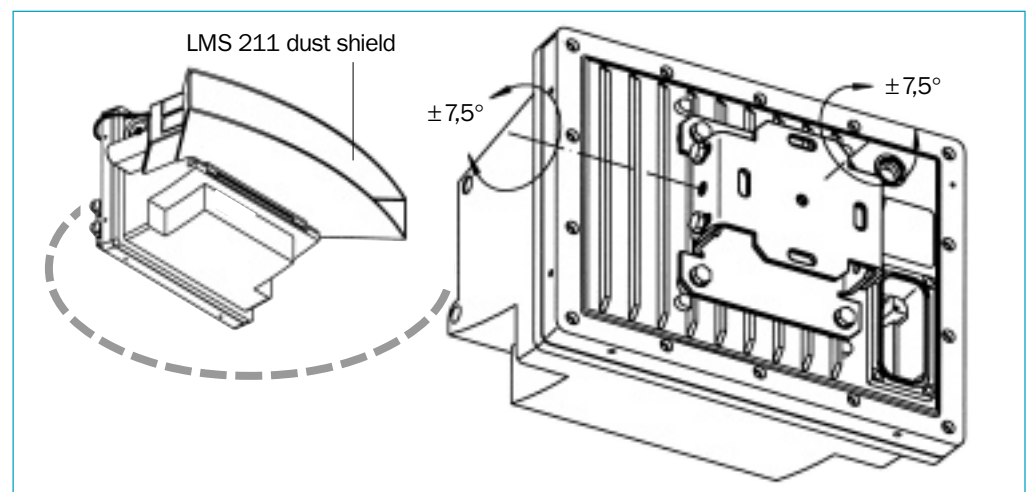


Fig. 6-1: Mounting set for LMS 220/LMS 211/LMS 221

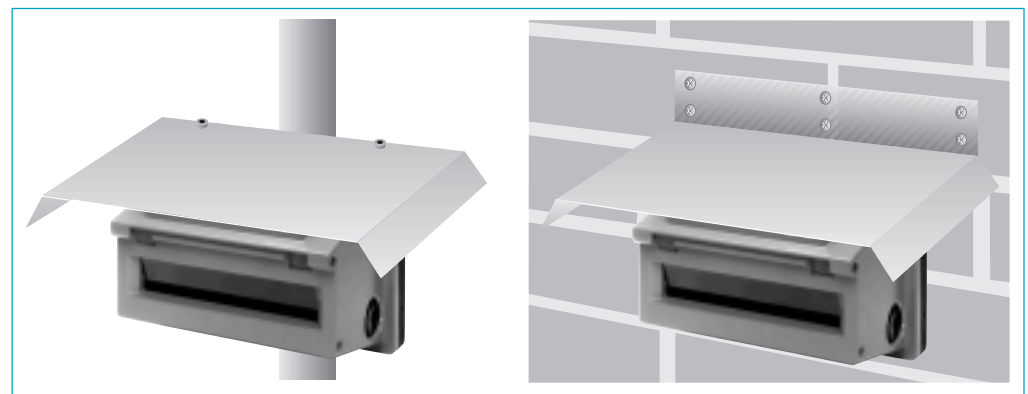


Fig. 6-2: Sunshade (examples)

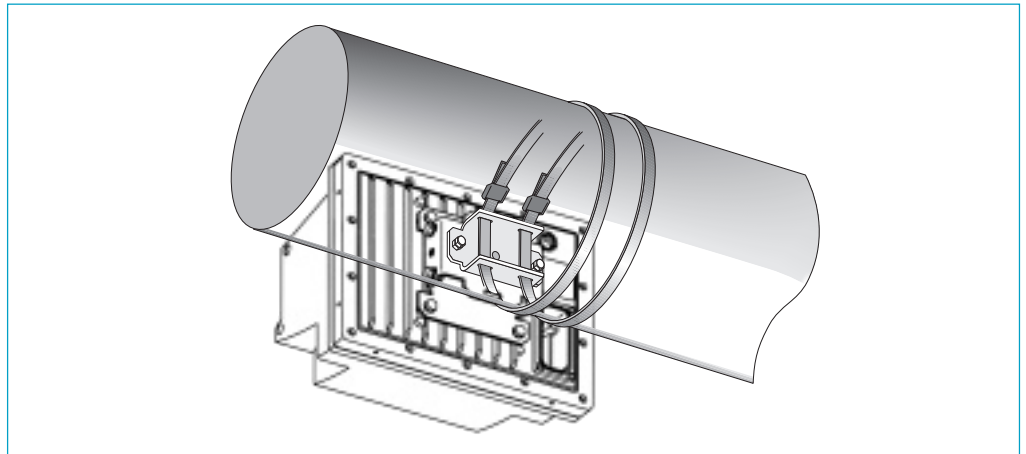


Fig. 6-3: Attachment set for mast mounting of LMS 220/LMS 211/LMS 221

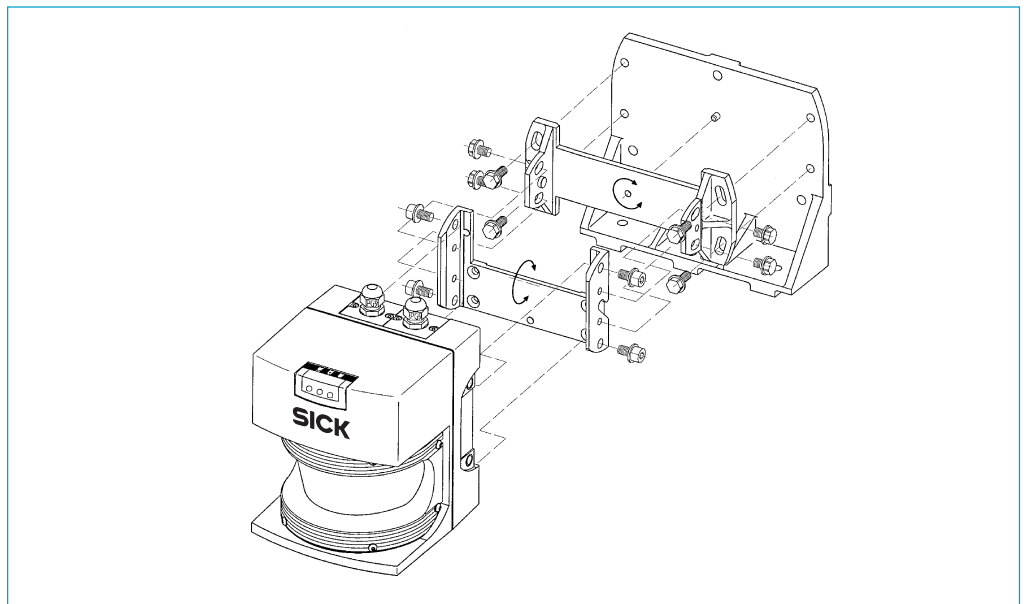


Fig. 6-4: Mounting set for LMS 200/LMS 291

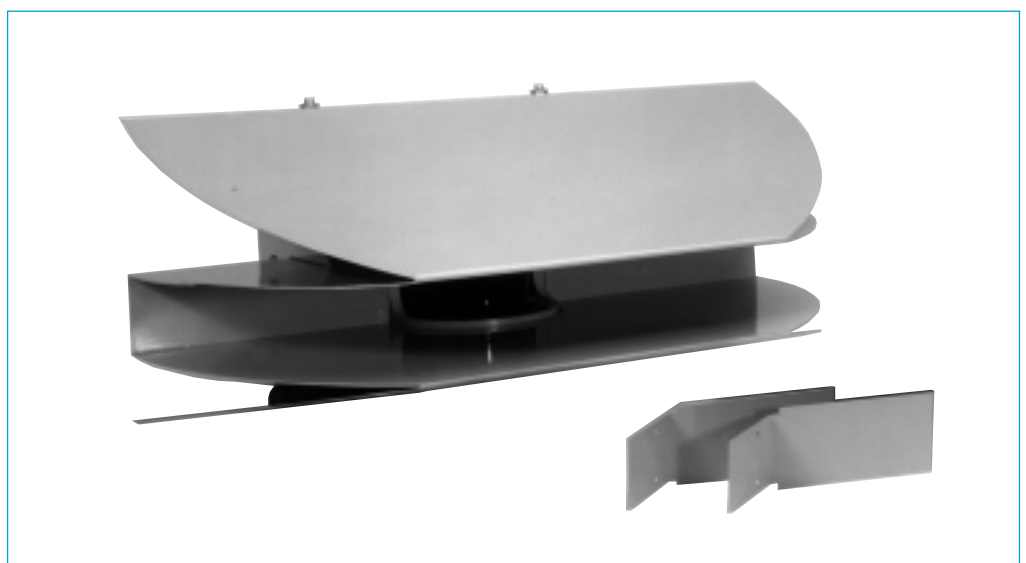


Fig. 6-5: Weather protection for LMS 220/LMS 221

7 LMS 211/LMS 220/LMS 221 electrical installation

The scanners' operating voltage is 24 V DC \pm 15%.

7.1 Data interface

The data interface of the scanners is for setting parameters using a PC and for data exchange on external software evaluation (e.g. with SICK's LMI Laser Measurement Interface). The interface type may be selected as RS 232 or RS 422 by bridging in the connection plug. A prepared service cable is available for setting parameters (see 14: Order numbers).

Please note:

A shielded cable with "twisted pair" wires (2x2 TP, see 14: Order numbers) is required for operation with external data evaluation in real time.

7.2 Power supply

The electronics of the scanners is fed directly from a stabilised 24 V DC mains adapter. The LMS 211/LMS 220/LMS 221 scanner heater is regulated internally by a thermostat. An unregulated 24 V DC mains adapter is sufficient for power supply for the heater (current uptake of active heater is approx. 5 A). In the LMS 211/LMS 221, separate connection terminals are available in the connection plug for the scanner heater/motor flap. By using separate wiring it is possible to keep the heater in operation even when the scanner is switched off for longer periods – in order to maintain the operating temperature at a suitable level until the scanner is switched back on (prevents subsequent thawing within the scanner).

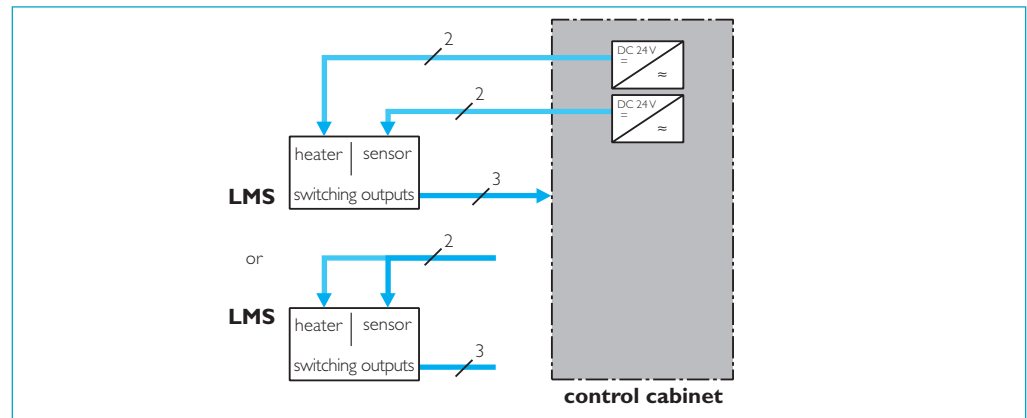


Fig. 7-1: Wiring for stand-alone operation (switching applications)

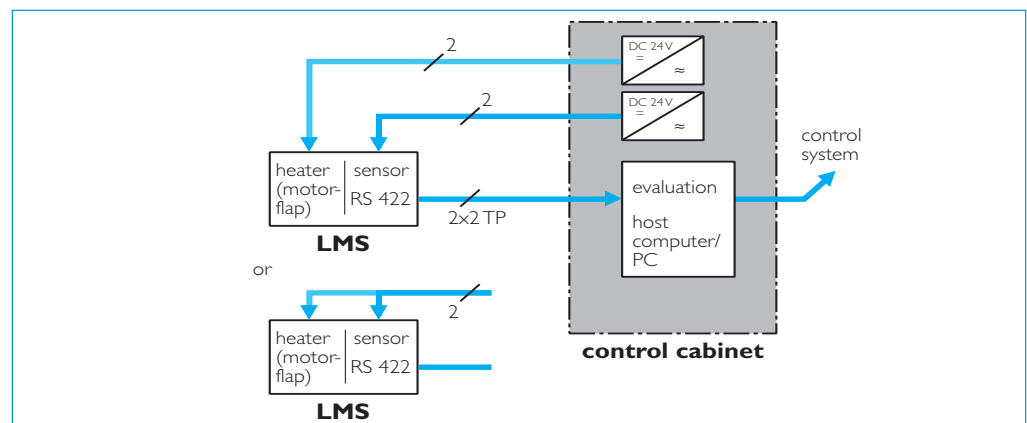


Fig. 7-2: Wiring with external data processing

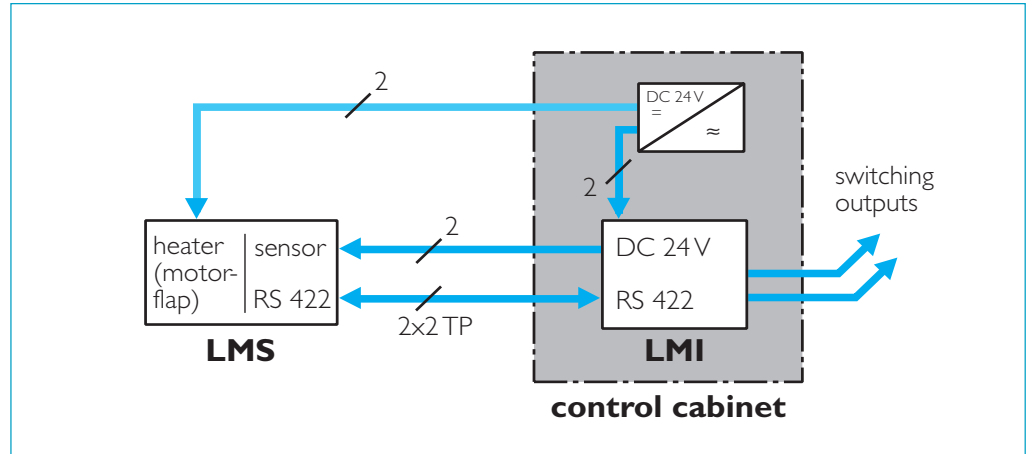


Fig. 7-3: Wiring in conjunction with LMI

Please note:

Observe acceptable voltage drops through the cable. The entire heating capacity (required at temperatures below -10°C) is only available with at least 24 V rated voltage (see *13 Technical data*). The voltage drop through cables at a current flow of 5 A is 0.114 V/m with a cable cross-section of 1.5 mm² and 0.075 V/m with a cross-section of 2.5 mm².

7.3 Motor flap for the LMS 211

The optional motor flap in the dust prevention shield is connected directly to the LMS using the prepared plug (socket at the rear of the housing).

The LMS heater power supply must be connected to operate the motor flap. Configuration takes place using the LMI user software, by separate data telegram to the LMS, or with a 24 V DC control voltage on pin 5 of the connection plug (see also *Fig. 7-4*).

If the motor flap is not in use, or is no longer in use, the connection socket must be covered with the cap (to maintain the enclosure rating).

7.4 LMS 211/LMS 220/LMS 221 electrical connection

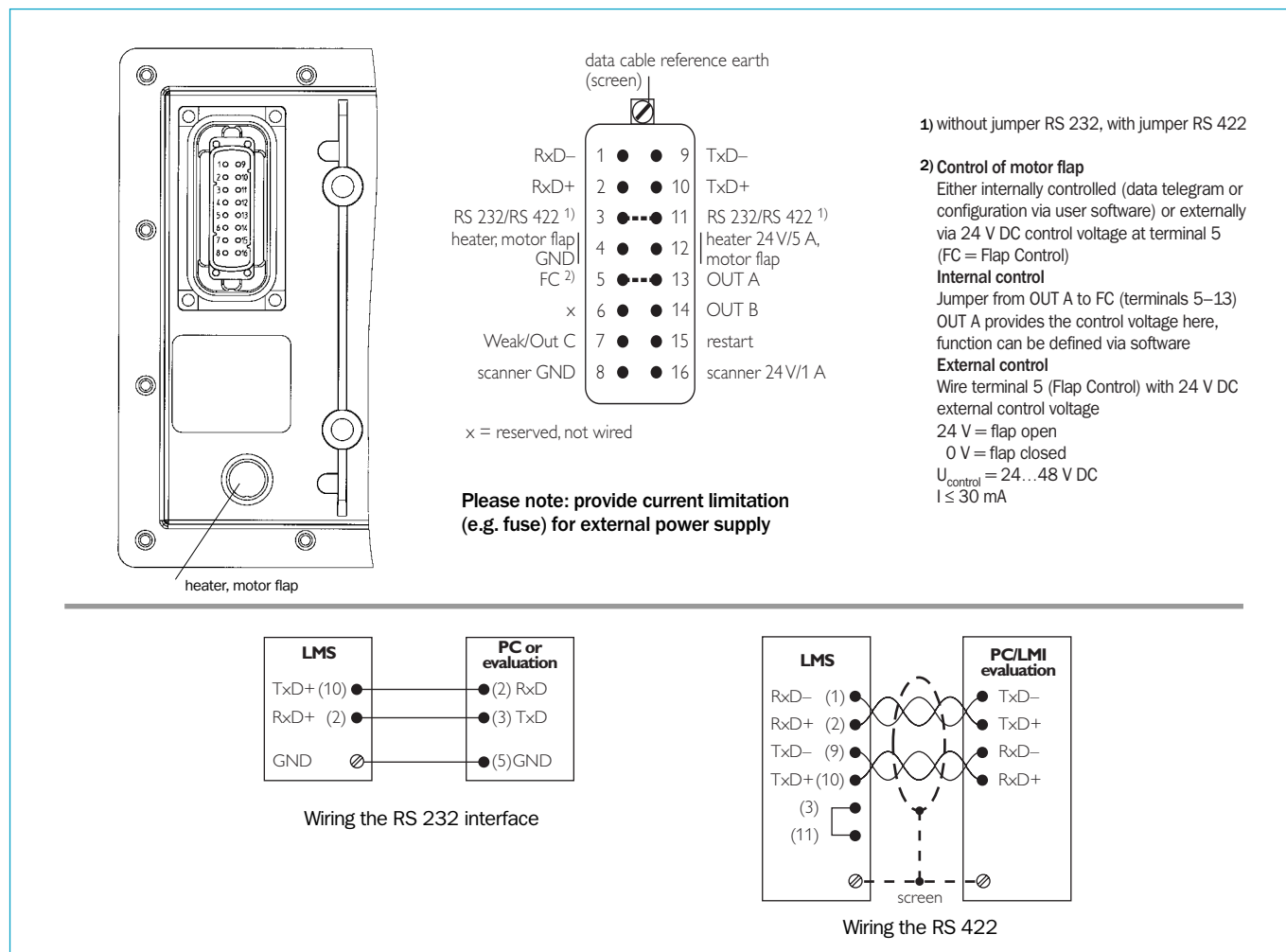


Fig. 7-4: LMS connection plug/interface wiring terminal allocation

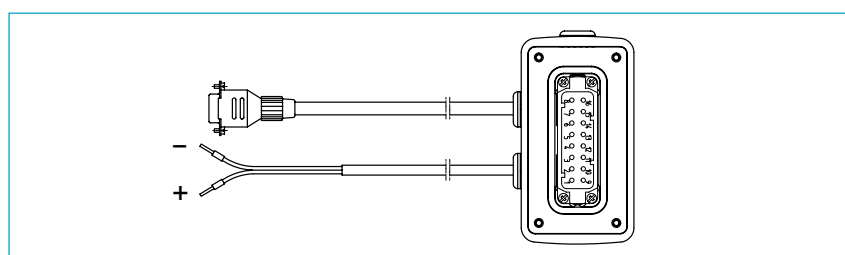


Fig. 7-5: Service cable for setting parameters (prepared as RS 232 for PC, can also be used for RS 422 with jumper between terminals 3-11)

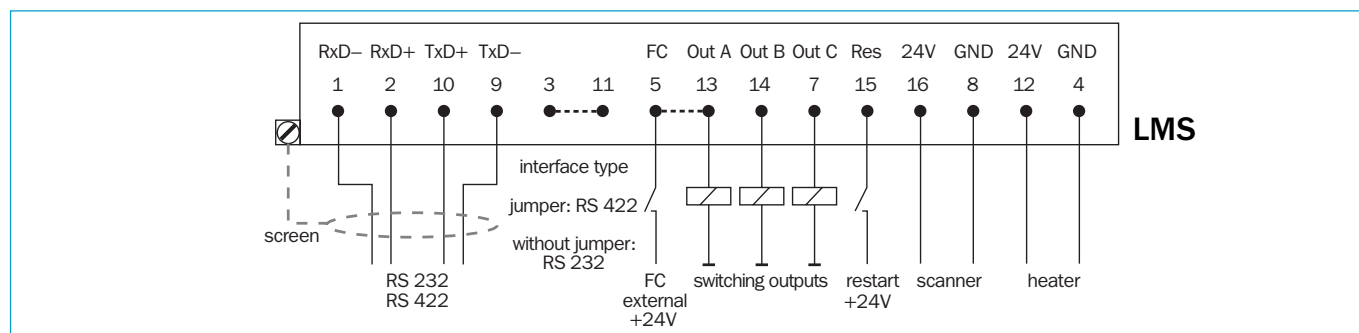


Fig. 7-6: LMS 211/LMS 221/LMS 220 wiring

7.5 Electrical connection LMS 211/LMS 221 with relay outputs

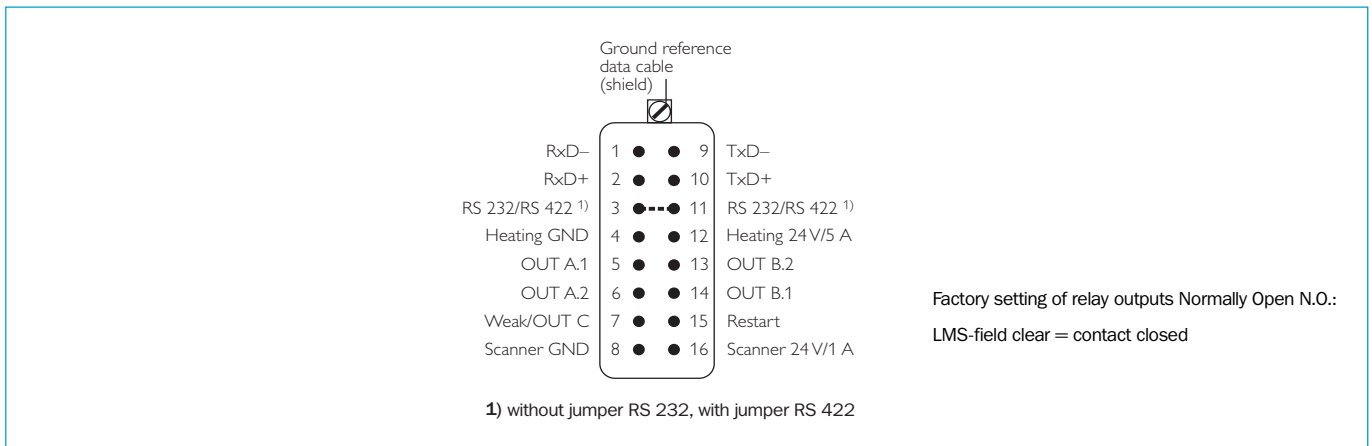


Fig. 7-7: Layout of the connection plug

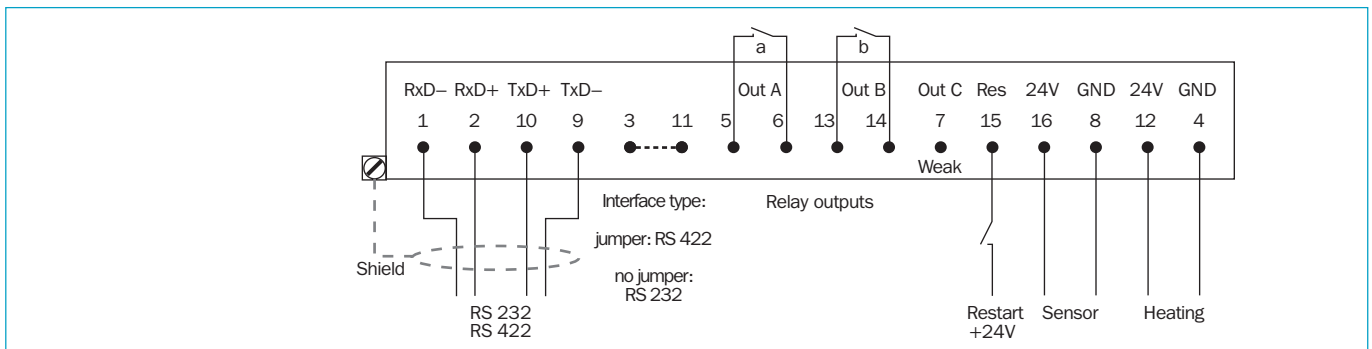


Fig. 7-8: Connection diagram of LMS 211/LMS 221 with relay outputs

Note:

Motor flap on LMS with relay outputs not applicable.

Behaviour of the switching outputs

All LMS types are designed in such way, that the switching outputs are active (24 V-level) if the corresponding monitored field is clear. If, however, a field is infringement the relevant output switches to 0 V-level. The contacts of LMS units with relay output on OUT A and OUT B are set to N.O. function. The corresponding contact is closed when the monitoring field is clear and opens if there is a field infringement.

This functionality of the switching outputs means, that the connecting cables are automatically monitored for any breaks.

Output OUT C is designed to act as a regular field output but automatically assumes an error signalling function if there is a break (see also *Chap. 8.3.3*).

8 Electrical connection LMS 200/LMS 291

8.1 Electrical connection

Scanners require an operating voltage of $24\text{ V DC} \pm 15\%$ with a power consumption of $\leq 20\text{ W}$ plus the load on the three possible outputs OUT A (max. 250 mA), OUT B (max. 250 mA) and OUT C (max. 100 mA).

The restart input can be allocated as restart or for changing field (see LMS/LMI User Software Operating Instructions for details).

Power is supplied to the devices using a plug-in connection box with a high enclosure rating (see Fig. 8-2), while interface connection takes place through another connection box (RS 232 or RS 422).

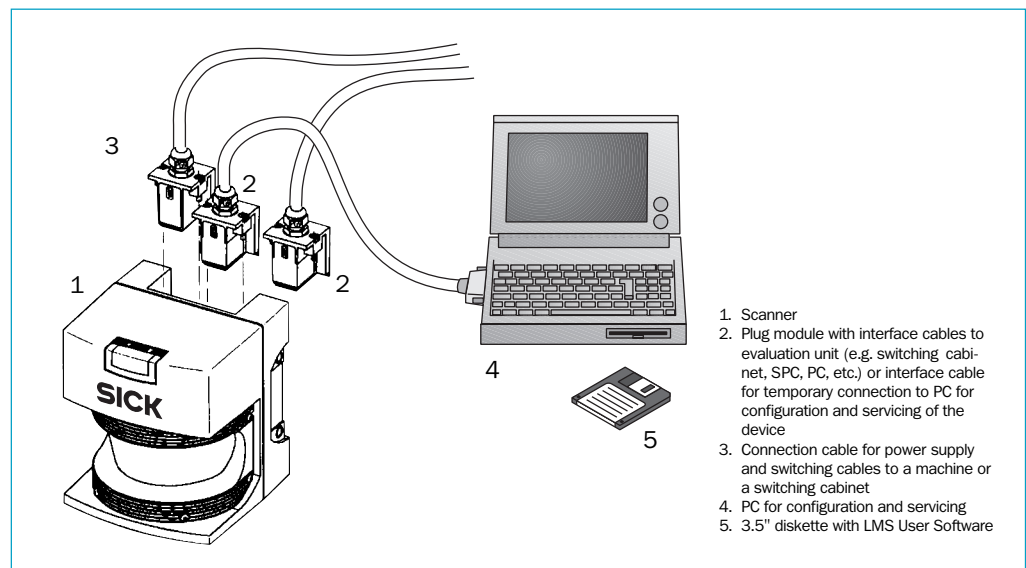


Fig. 8-1: LMS 200/LMS 291 components and typical set-up

8.2 Interface plugs (plug modules)

The interface plugs are built into plug modules. Only when attachment of the plug modules to the sensor has been completed does the device correspond to the IP 65 design and EMC requirements (ESD) according to CE.

Furthermore, please note that regarding ESD protection the LMS should only be operated with the plug modules mounted.

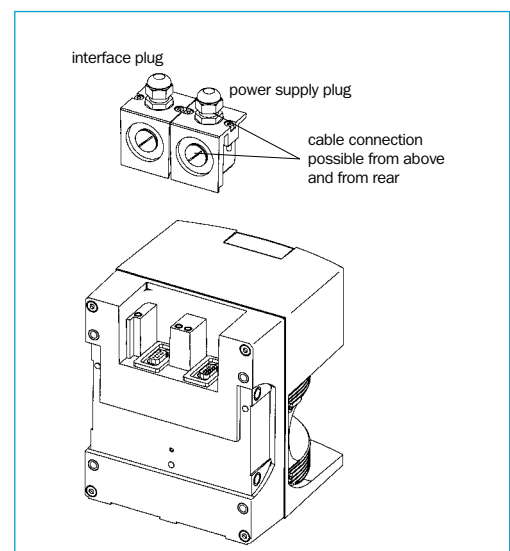
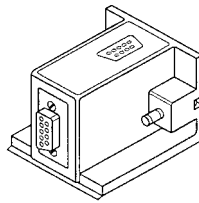
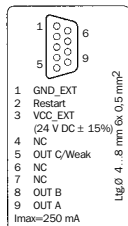


Fig. 8-2: Scanner with plug-in connection boxes

8.3 LMS 200/LMS 291 electrical connection

PIN	Signal designation	Input/output	Wire colour
1	GND_EXT (earth)	—	brown
2	Restart	E	blue
3	VCC_EXT (24 V DC \pm 15%)	—	red
4	NC	—	—
5	OUT C/weak signal	A	grey
6	NC	—	—
7	NC	—	—
8	OUT B	A	turquoise
9	OUT A	A	orange

Please note: Provide current limitation (e.g. fuse) for external power supply

Fig. 8-3: LMS 200/LMS 291 power supply plug

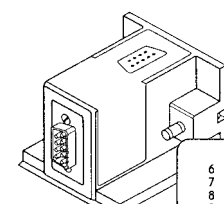
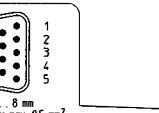
8.3.1 RS 232/RS 422 conversion

The prepared interface plug is converted to an RS 422 form using a standard bridge. The interface plug reverts to the RS 232 form on removal of the bridge.

Please note:

Bridging may only be carried out within the plug module.

PIN	Signal designation RS 232	RS 422	Input/output
1	NC	RxD—	—
2	RxD	RxD+	E
3	TxD	TxD+	A
4	NC	TxD—	—
5	GND	GND	—
6	NC	NC	—
7	NC	jumped	—
8	NC	RS 422	—
9	NC	NC	—

RS 232/RS 422

Fig. 8-4: Interface plug

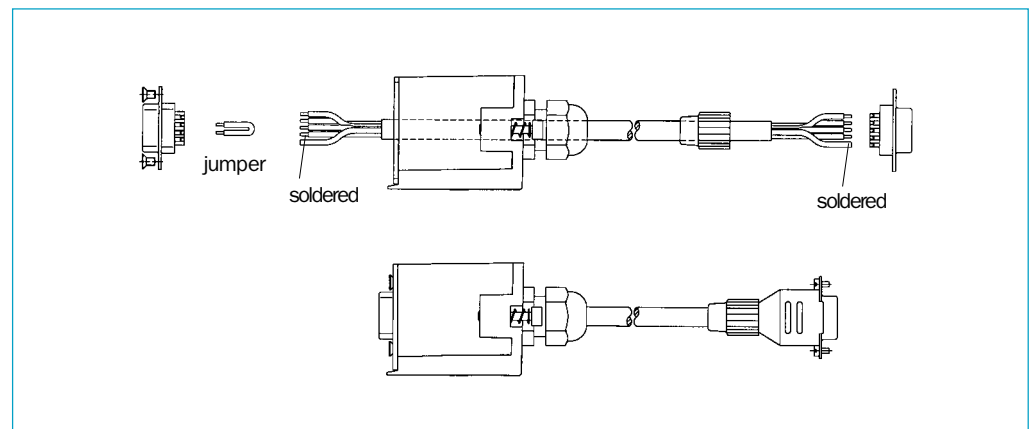


Fig. 8-5: Convertible interface plug (RS 422 pre-selected)

8.3.2 Cable entry in plug module

Cables can enter the plug module from above or from the rear.

Please note:

In order to ensure that the scanner is sufficiently sealed (IP 65), the LMS must always be provided with plug modules – even if the interface is not in use. The plug modules must be provided with breach screws or PG cable glands with seals and SUB-D device plugs.

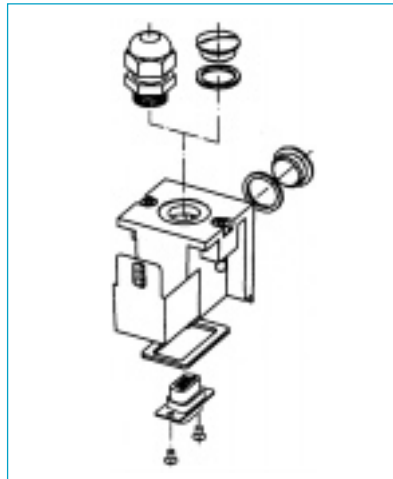


Fig. 8-6: Plug module structure

8.3.3 Functions of the indicator lights

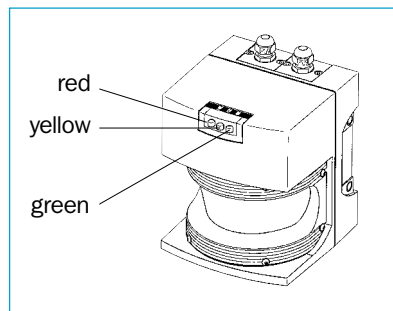


Fig. 8-7: The indicator lights on LMS 200/LMS 291

State of system	LED green	LED yellow	LED red	Indication static	LED yellow frequency	Error signal (OUT C)
Initialising (start)	0	1	1	•		
OK, all fields clear	1	0	0	•		
Field infringed (A, B, C)	0	0	1	•		
Download	1	1	0	•		
Restart requested; Restart timed (Field A)	0	1	1	•		
Contamination- Warning		1			1 Hz 50% on/50% off	
Contamination- Error	0	1	1		1 Hz 90% on/10% off	1 Hz 90% on/10% off
Error	0	1	1		1 Hz 10% on/90% off	1 Hz 10% on/90% off
Fatal Error	0	1	1		1 Hz 50% on/50% off	1 Hz 50% on/50% off
Switching signal on OUT C alternatively as field output or error signal (higher priority)						

Tab. 8-1: Functions of the indicator lights

9 Synchronisation of two laser scanners

If two LMS units are operated in close vicinity to each other, e.g. for measuring packages, there may be mutual interferences under certain circumstances. In order to prevent this the rotating mirrors of the two LMS units can be synchronised. The mirrors are then maintained in a position displaced by 180° relative to each other. In the process one LMS is defined as the MASTER, the other the SLAVE.

9.1 Pre-conditions for synchronisation

Scanners are capable of synchronisation from software version 02.03 and above and hardware class serial no. 9919... and above.

The scanners are wired according to the wiring plan Fig. 9-1 below.

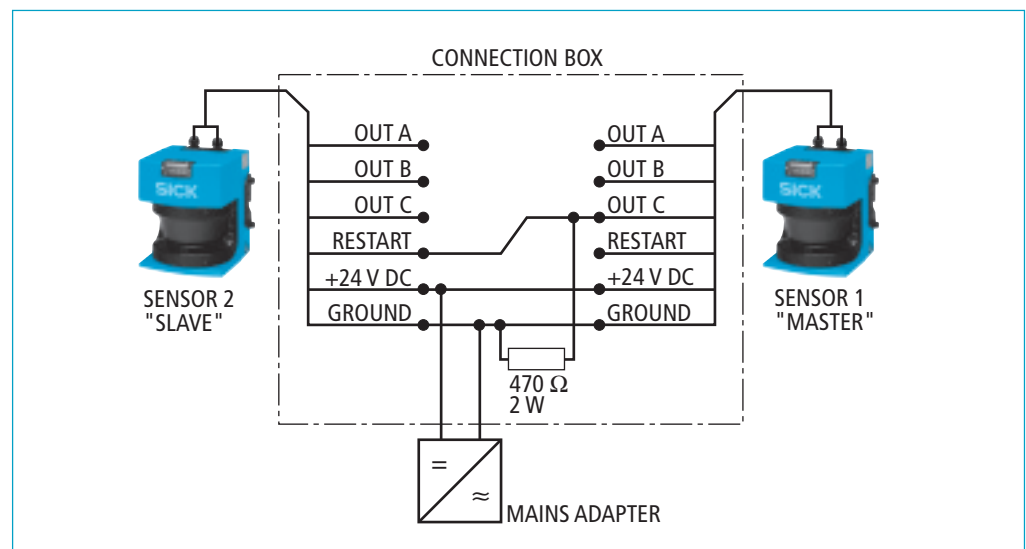


Fig. 9-1: Connection diagram synchronisation

9.2 Procedure

- Wire scanners with power supply cables from the connection set
- The maximum length of each of the supply cables should not exceed 5 m
- Both scanners must be supplied **from a common mains adapter**
- The separation of the power supply for the two scanners must first take place in the connection box (see *14 Order numbers*)
- The MASTER output OUT C is connected to the SLAVE RESTART
- Wire a pull-down resistance of $470\ \Omega/2\ \text{W}$ to GND_EXT (supplied with the connection box). The linkage takes place in the connection box.

The remaining scanner outputs can be led from the connection box to the switching cabinet without any further measures being taken.

The scanner data cables must not be wired through the connection box. Observe instructions in the Technical Description when selecting the type of interface and acceptable cable lengths.

9.3 Commissioning synchronisation

Reaction of the scanners on power-on

- The MASTER gives out its synchronisation pulse immediately after configuration has taken place
- The SLAVE independently synchronises itself after RESET or POWER ON

Synchronisation behaviour of the SLAVE

Possible states after RESET during the synchronisation phase

SLAVE (LEDs)	red	yellow	green	approx. duration
1 Waiting for synchronisation signal from MASTER	100%	50% 0.5 Hz	0%	max. 45 s
2 Synchronisation phase (adaption of the number of rotations)	100%	100%	100%	
3 Synchronisation adjusted to pre-defined phase state	100%	0%	100%	appr. 4 s
4 Synchronisation completed	100%	100%	0%	*)
5 Scanner operating state OK	0%	0%	100%	
Error	100%	0%	0%	*)

*) If the synchronisation process has not been completed after 100 seconds the process is aborted and an error displayed.

The LED indicators of the MASTER act as in standard mode (see Chapt. 8.3.3).

After synchronisation has taken place in the initialisation phase, the synchronisation status is cyclically controlled and monitored. On loss of synchronisation for a period longer than 10 seconds and shorter than 30 seconds an info is entered in the SLAVE error log.

On loss of synchronisation for a period longer than 30 seconds an error is entered in the SLAVE error log.

If the SLAVE is able to synchronise itself again, the error entry is deleted or saved as a non-current error.

In synchronisation mode the MASTER suffers just one restriction, namely that output OUT C cannot be used for the field monitoring function.

Please note:

The connection box corresponds to enclosure rating IP 65, but IP 54 on use of the PG 11 and PG 16 screw joints. If enclosure rating IP 65 is required, the appropriate PG screw joints are to be used (Tradeware).

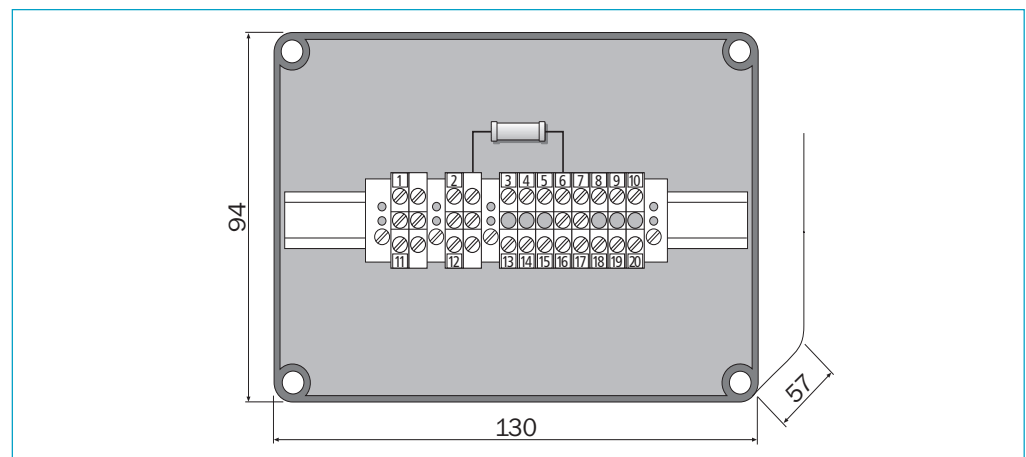


Fig. 9-2: View into connection box for synchronisation

10 Heating plate for the LMS 200/LMS 291

A supplementary heating plate is required if scanners with IP 65 housings are operated below 0° C.

The heating plate is mounted between the back plate of the scanner and the standard mounting set.

The temperature of the heating plate is controlled internally by a thermostat.

Attention should be paid to ensure that the heating plate lies level on the scanner rear and that the transfer of warmth is not hindered.

The connection terminals for the power supply are below the cover. Conventional cables can be used for connection.

The device is to be safeguarded with an FI safety switch.

Technical data (electrical)

Power supply	230 V AC \pm 10%
Power uptake	30 W (cyclic, thermostat-controlled)
Peak current on power on	< 2.5 A
Supply line cable entry	PG 9
Supply line wire cross-sections	up to 1.5 mm ²

Technical data (mechanical)

Protection category	IP 65
Operating temperature	–12...+50 °C
Heating-up time at –12 °C	max. 20 min.
Storage temperature	–20...+70 °C
Dimensions	see Fig. 10-1
Weight	approx. 1.2 kg

Table 10-1: Heating plate technical data

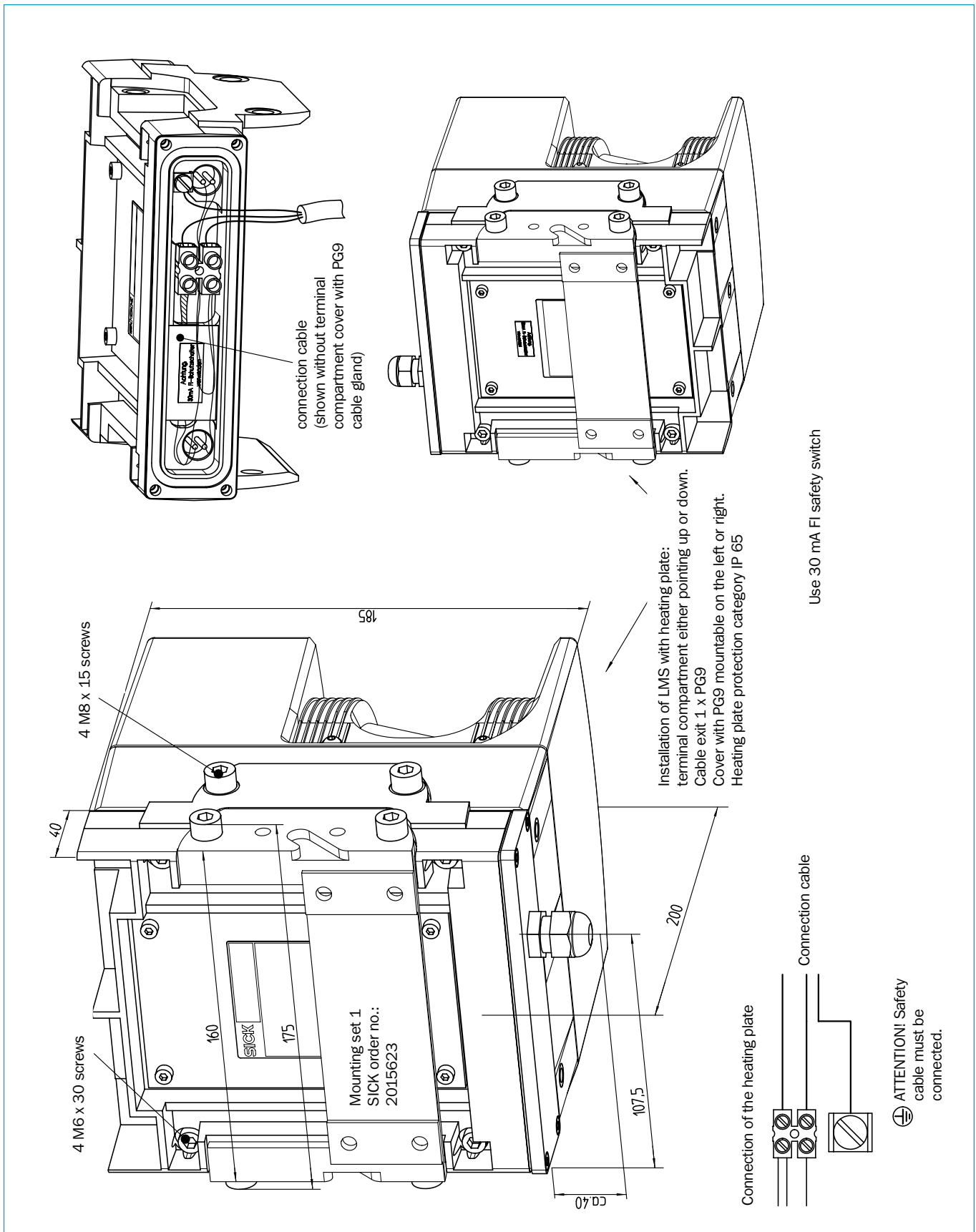


Fig. 10-1: Mounting the heating plate on the LMS 200/LMS 291

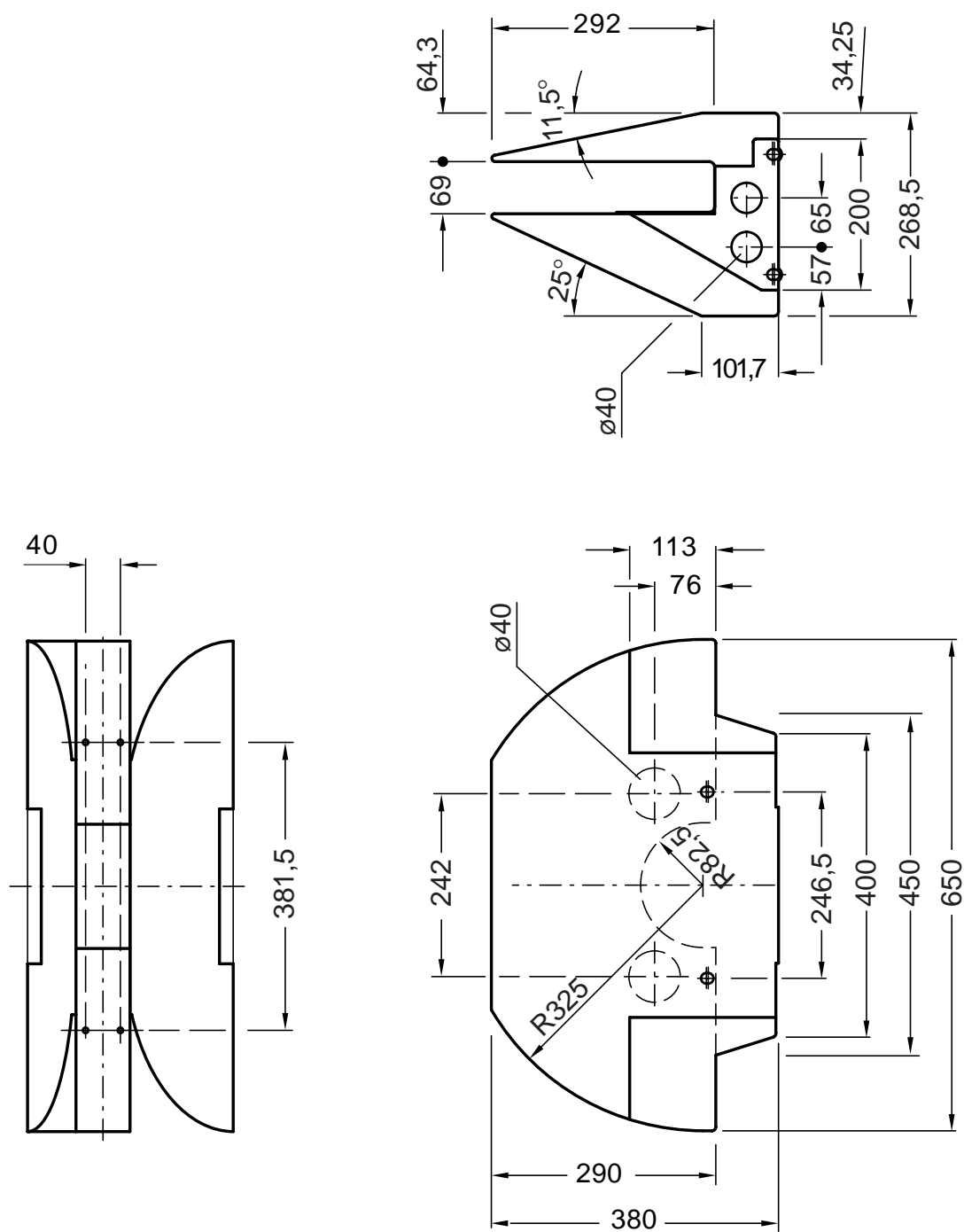


Fig. 10-2: Dimensions of weather protection for LMS 220/LMS 221

11 Dimensional drawings

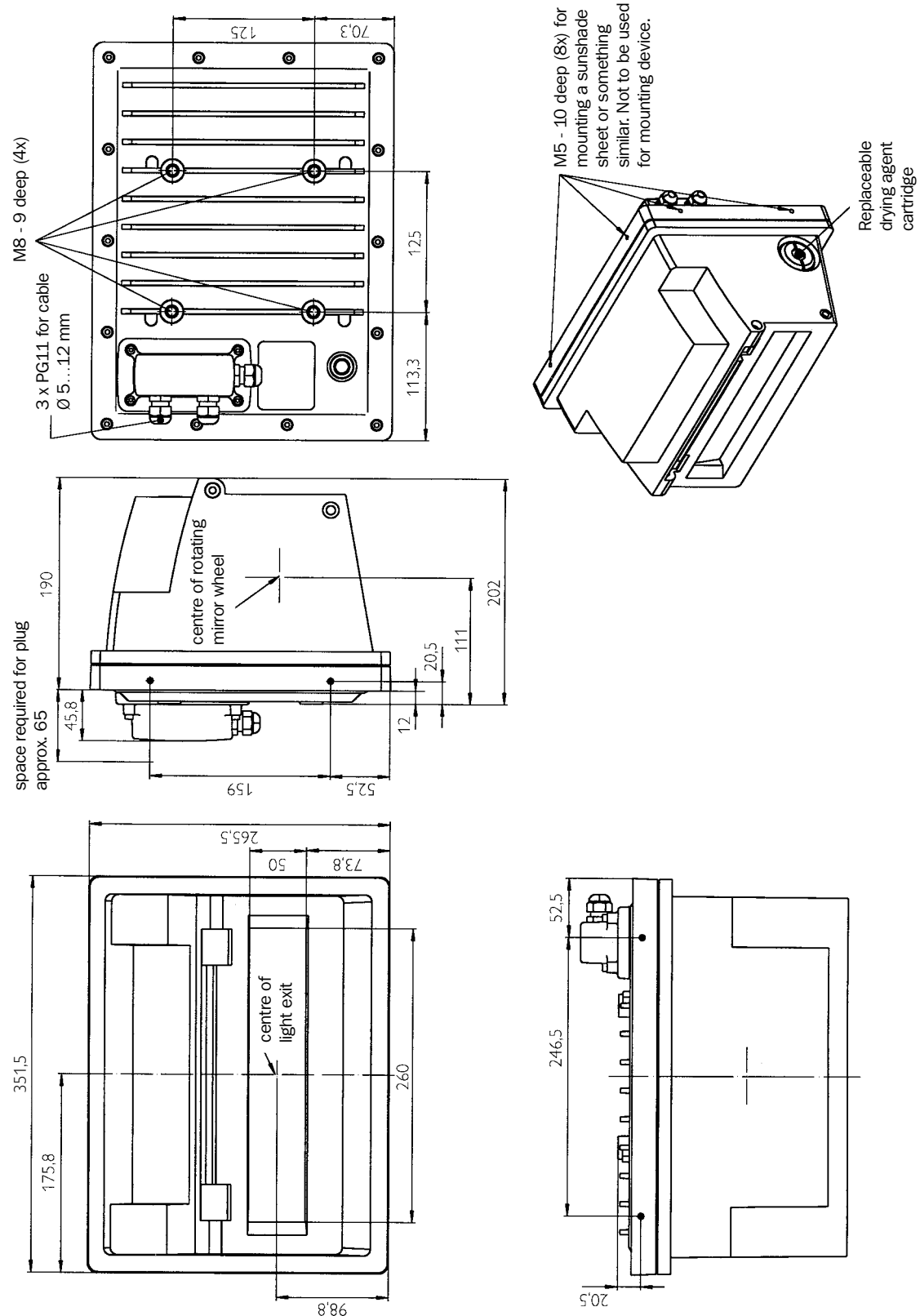


Fig. 11-1: LMS 211 dimensions

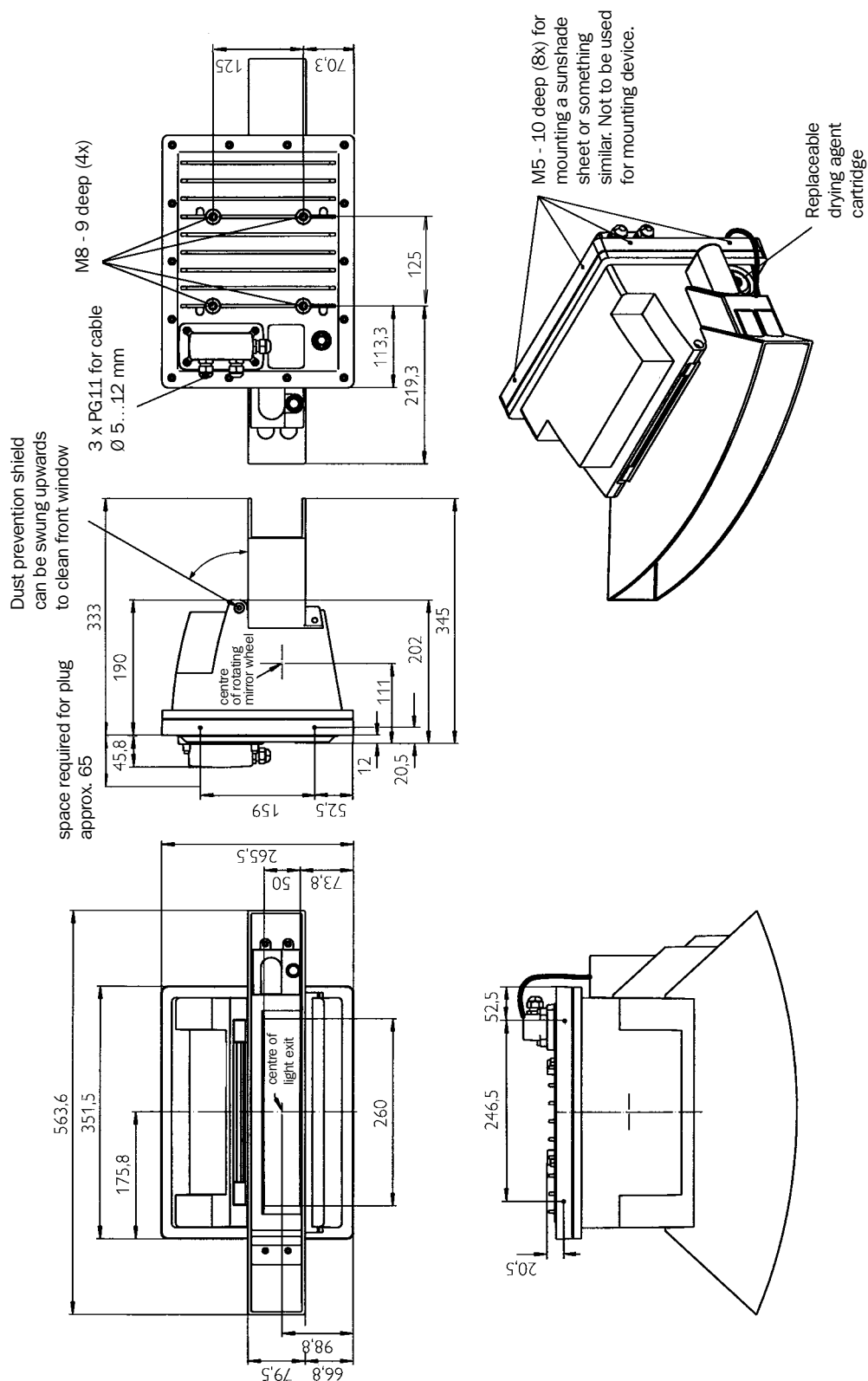


Fig. 11-2: LMS 211 dimensions with dust prevention shield

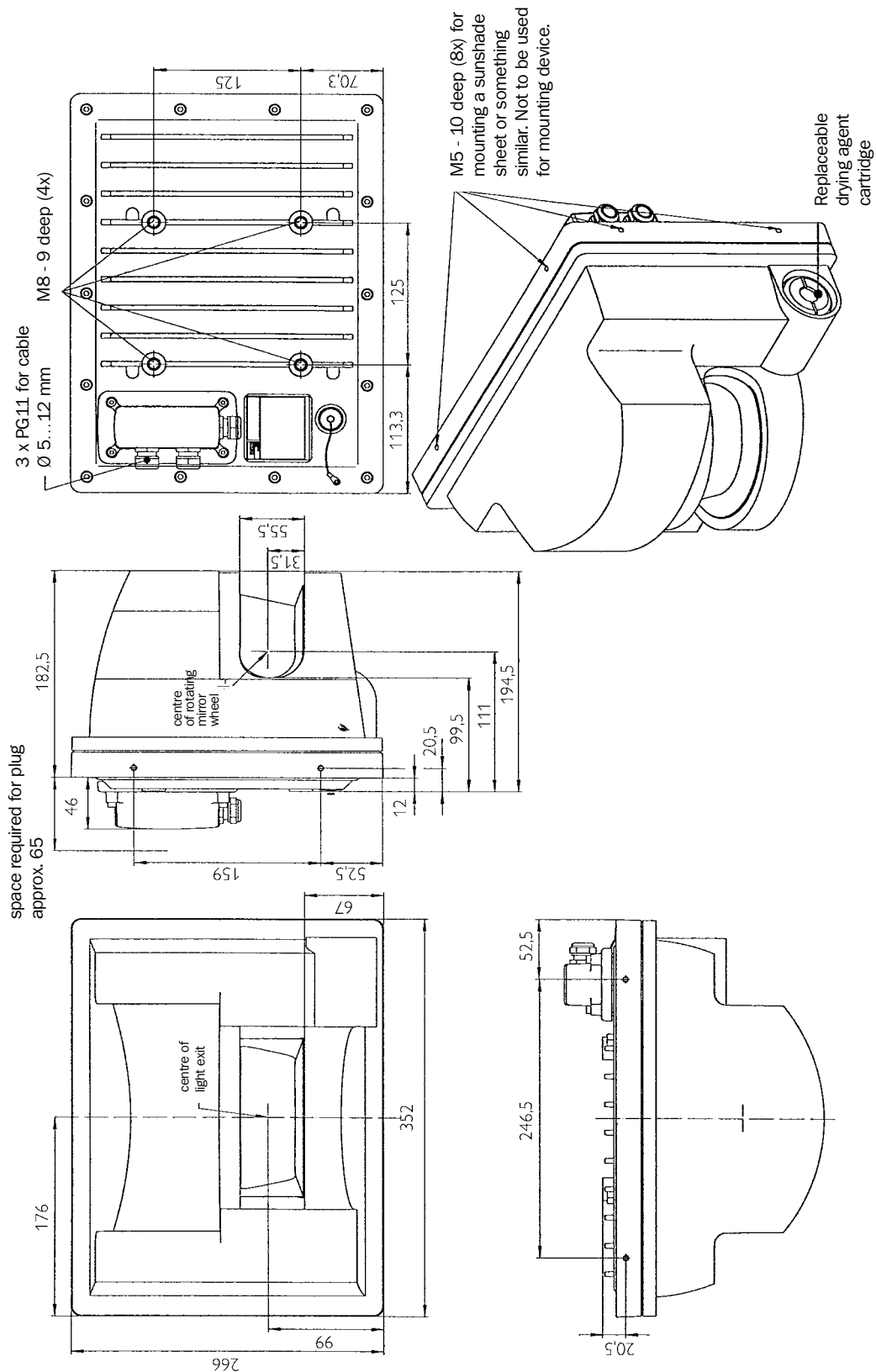


Fig. 11-3: LMS 220/LMS 221 dimensions

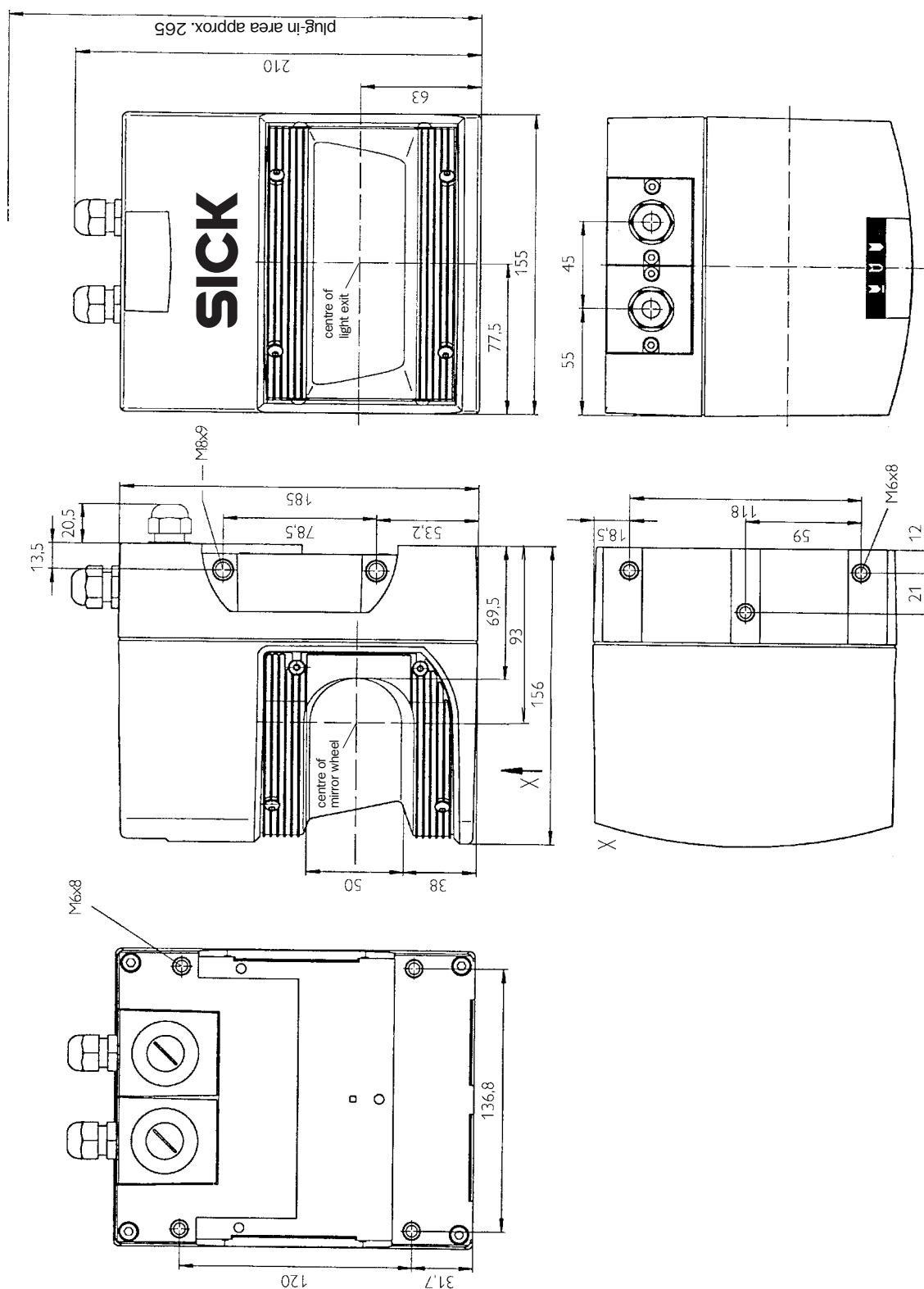


Fig. 11-4: LMS 200/LMS 291 dimensions

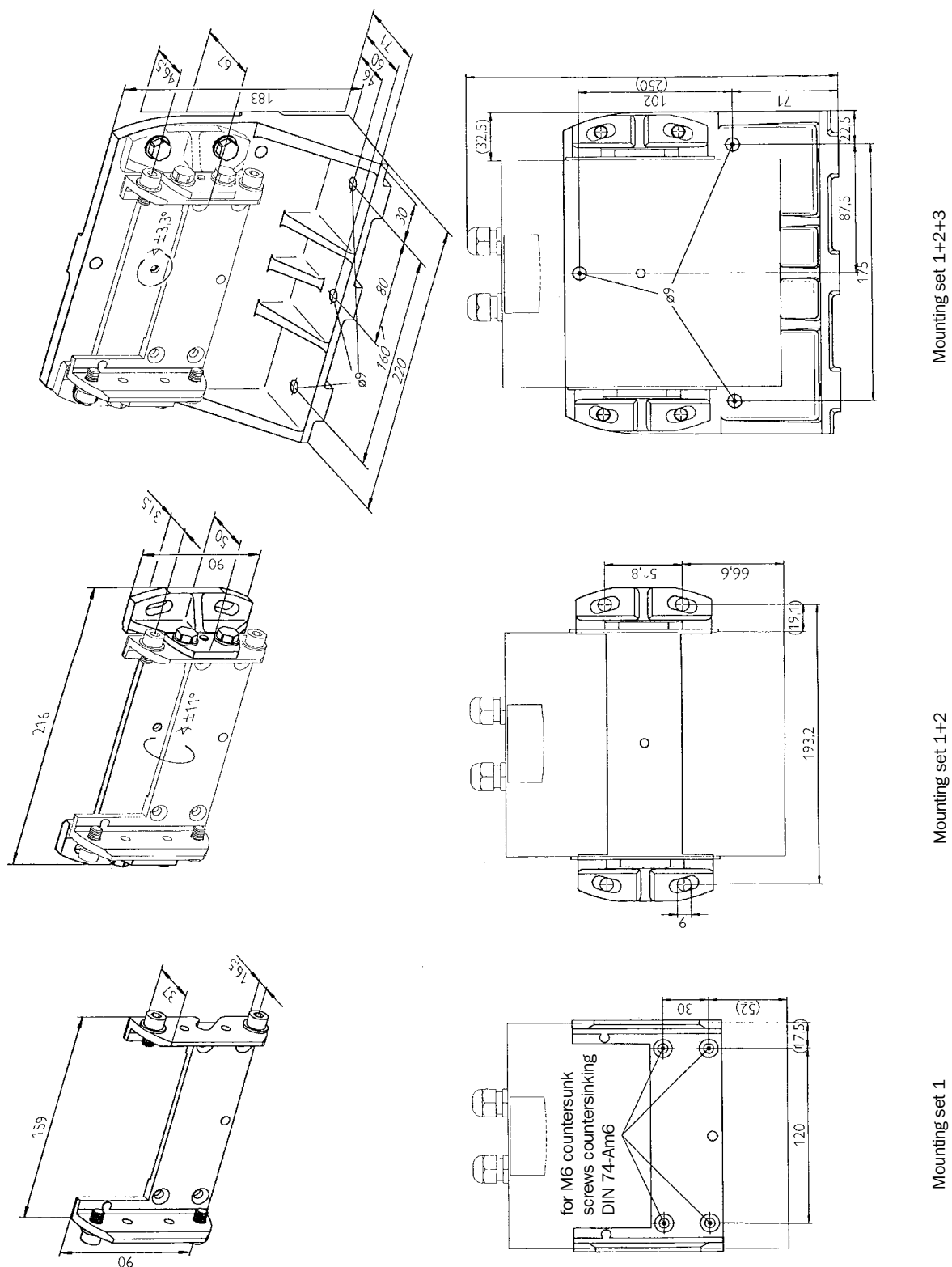


Fig. 11-5: Mounting sets 1, 2, and 3 dimensions

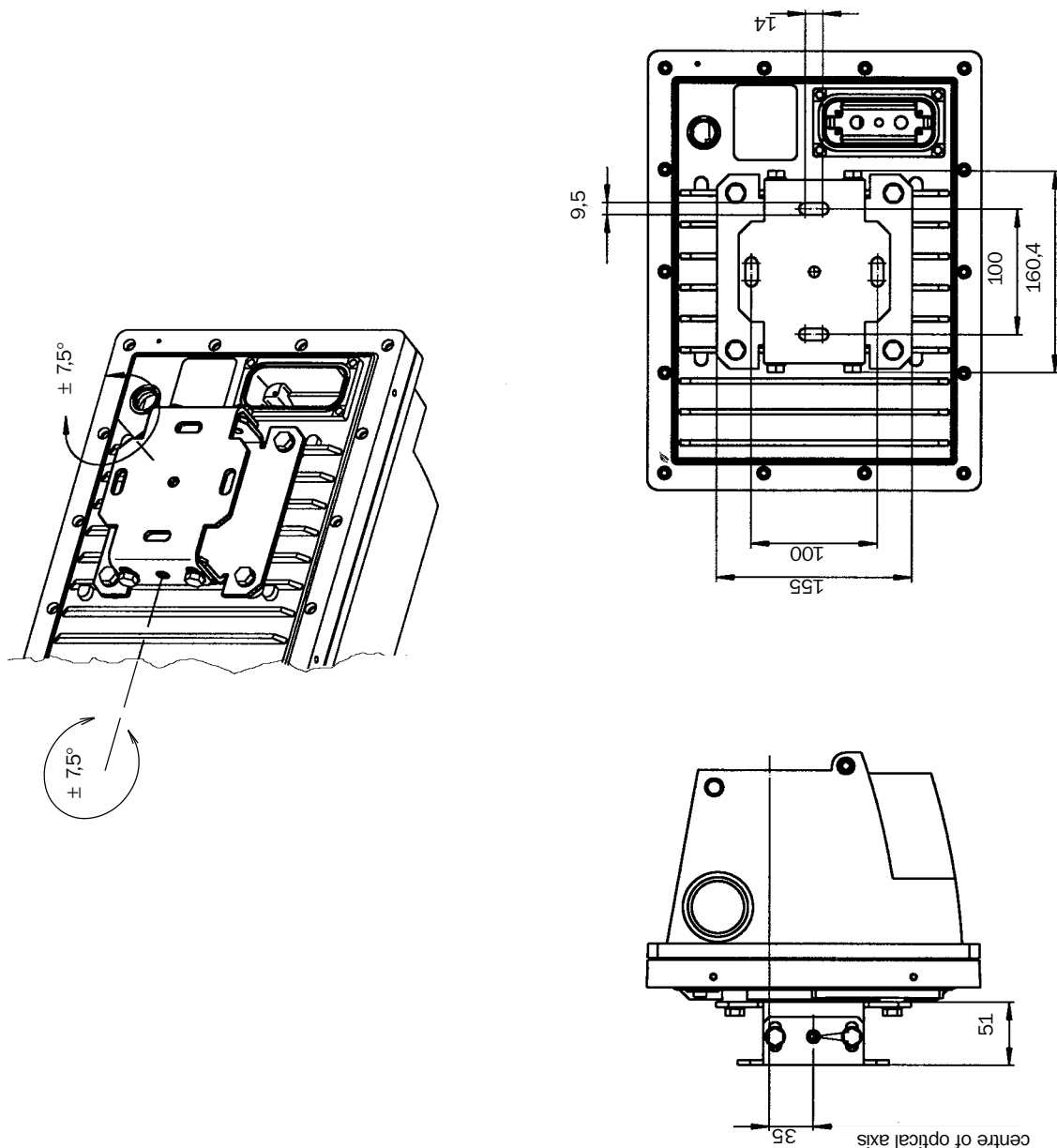


Fig. 11-6: LMS 211/LMS 221/LMS 220 mounting set

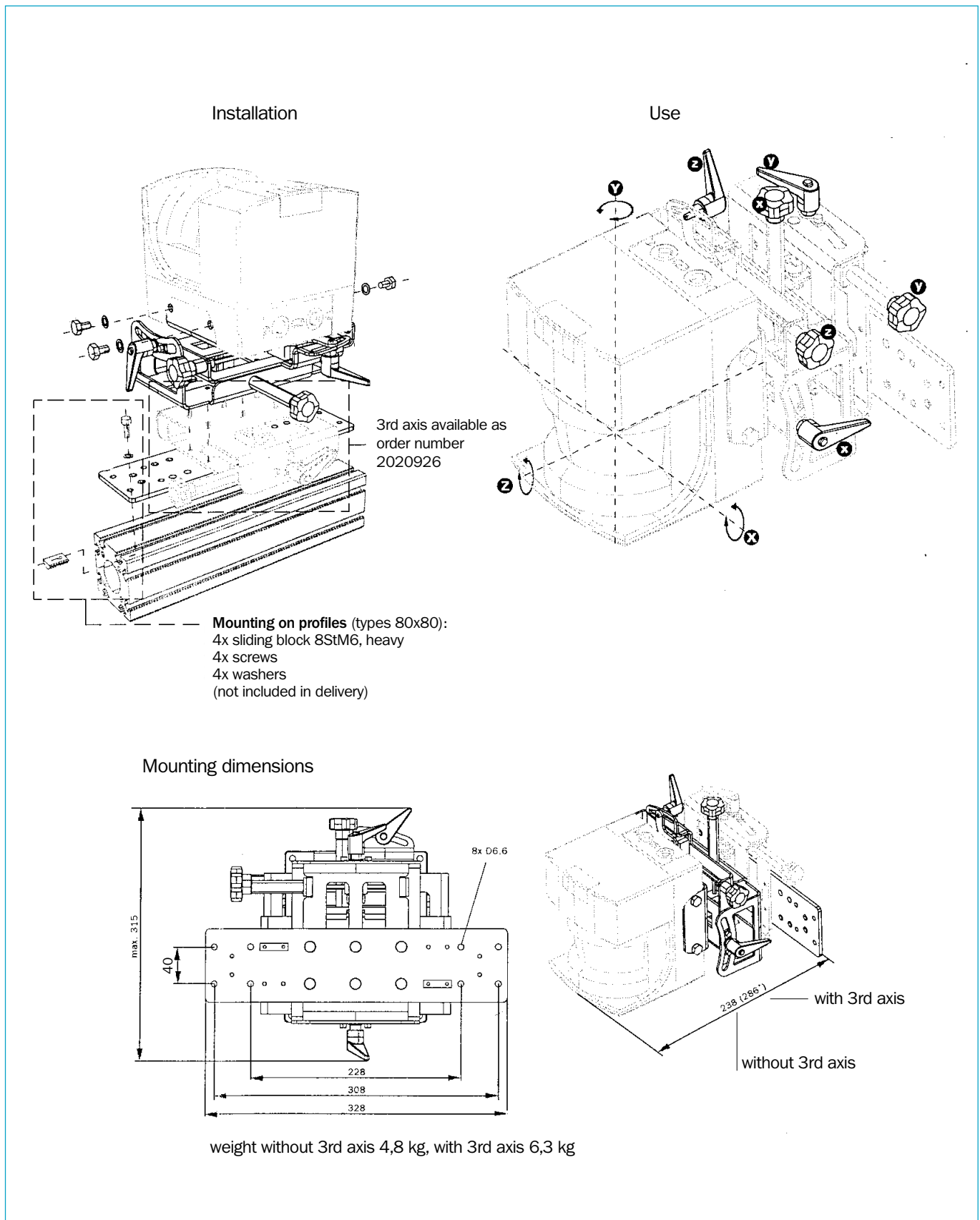


Fig. 11-7: LMS 200 fine adjustment mounting set

LMS 2...

12 Overview of LMS variants






	LMS type	Scanning angle	Resolution/typ. measurement accuracy	Typ. range with 10% reflectivity	Heating	Fog correction	Relay
	LMS 211-30206	100°	10 mm/± 35 mm	30 m	✓	✓	–
	LMS 211-S07	100°	10 mm/± 35 mm	30 m	✓	✓	✓
	LMS 221-30206	180°	10 mm/± 35 mm	30 m	✓	✓	–
	LMS 221-S07	180°	10 mm/± 35 mm	30 m	✓	✓	✓
	LMS 291-S05	180°	10 mm/± 35 mm	30 m	–	✓	–
	LMS 200-30106	180°	10 mm/± 30 mm	10 m	–	–	–
	LMS 220-30106	180°	10 mm/± 30 mm	10 m	✓	–	–

Table 12-1: Overview of LMS variants

Scanner functions

Function	LMS performance characteristics	Remarks	Default settings, delivery condition
Monitored fields, static	<ul style="list-style-type: none"> rectangular segmented (and teach-in) 	dynamic fields possible via LMI 400	A, B, C segmented, each 50 mm radial (indoor) each 5 cm radial (outdoor)
Number of field sets	2	expansion to 4 field sets with LMI 400	2
Switching field sets	external button or contact or telegram	further logical linkages possible via LMI 400	
Switching outputs 24 V DC	3	further 6 with LMI	
Switching outputs LMS 211/221 alternative with relay contacts	2	–	normally open
Subtractive fields	yes	monitored areas = field A minus field B	
Field evaluation	<ul style="list-style-type: none"> scan-oriented (blanking possible) pixel-oriented (no blanking) contour as reference 		pixel-oriented no blanking 2 scans multiple reading
Restart after field infringement	<ul style="list-style-type: none"> direct restart restart after defined delay restart interlock 	external button for switching field set or restart	direct, without time delay
Temporary field set	yes	field defined via external software (online)	
Measured value transfer in real-time (500 kBd)	yes		
Selectable baud rate: 9.6 kBd, 19.2 kBd, 38.4 kBd, 500 kBd	yes	500 kBd required for real-time transfer	9.6 kBd parity: none
Measurement range in mm	up to 8 m/16 m/32 m	range selectable	mm, indoor-LMS
Measurement range in cm	up to 80 m		cm, outdoor-LMS
Conversion of polar co-ordinates into Cartesian co-ordinates	yes	max. 200 measured values as Cartesian co-ordinates	polar co-ordinates
Measured value flags	<ul style="list-style-type: none"> infringement of field A, B, C or detection of reflector or dazzle, field A, B 	data output supplementary information, e.g. for navigation using reflector marks	fields A, B; dazzle
Minimum perpendicular distance	yes	measured values for fields A, B, C	
Measured value output	<ul style="list-style-type: none"> all measured values of a scan averaged measured values (up to 250 scans) measured values for partitioned sector averaged measured values for partitioned sector (up to 250 scans) 		measured values on request

Table 12-2: Overview of scanner functions

13 Technical data

Definition

measuring accuracy

Resolution

The resolution of a measuring device is the smallest possible distance different from zero between two consecutive individual measurement values. The resolution can be reduced by using averaged values.

Systematic error

Systematic error is the sum of all the deviations over a defined extent of range and reflectivity, which cannot be reduced even using averaged values.

Standard deviation

The standard deviation is calculated using at least 100 measurement values of a target with a certain reflectivity at a certain distance with a certain amount of illumination.

General

Range	max. 80 m (see Chapter 4)	
Angular resolution	0.25°/0.5°/1° (selectable)	
Response time	53 ms/26 ms/13 ms	
Measurement resolution	10 mm	
System error (environmental conditions: good visibility, Ta=23°C, reflectivity 10%...10,000%)	LMS 200-30106/ LMS 220-30106 typ. ± 15 mm (mm-mode), range 1...8 m typ. ± 4 cm (cm-mode), range 1...20 m	LMS 211/LMS 291/ LMS 221-30206 typ. ± 35 mm (mm-mode), range 1...20 m typ. ± 5 cm (cm-mode), range 1...20 m
Statistical error standard deviation (1 sigma)	typ. 5 mm (mm-mode) (at range ≤ 8 m/ ≥ 10 % reflectivity/≤ 5 kLux)	typ. 10 mm (mm-mode) (at range 1...20 m/ ≥ 10 % reflectivity/≤ 5 kLux)

Electrical

Data interface	RS 232/RS 422 (configurable)	
Transfer rate	9.6/19.2/38.4/500 kbaud	
Switching outputs, standard variants	3xPNP; typ. 24 V DC OUT A, OUT B max. 250 mA, OUT C max. 100 mA	
Switching outputs, relay variants	OUT A, OUT B (relay) max. switching voltage 48 V DC/26 VAC (protected low voltage, safe isolation from mains) max. switching current 0,7 A; max. switching power 30 W OUT C/weak (PNP) typ. 24 V DC, max. 100 mA	
Supply voltage (scanner-electronics)	24 V DC ± 15% (max. 500 mV ripple) current requirement max. 1,8 A (incl. output load)	
Supply voltage (heating, LMS 211/220/221 only)	24 V DC (max. 6 V ripple) current requirement max. 6 A (cyclic)	
Power consumption	approx. 20 W (without output load) plus heating with approx. 140 W	
Electrical protection class	safety insulated, protection class 2	
Laser protection class	1 (eye-safe)	
Interference resistance	acc. to IEC 801, part 2-4; EN 50081-1/50082-2	
Operating ambient temperature	0...+50 °C -30...+50 °C (warming-up time approx. 120 min.at T _{min})	
Storage temperature	-30...+70 °C	

Mechanical

	LMS 200-30106/LMS 291-S05	LMS 211/220/221
Enclosure rating	IP 65	IP 65 and IP 67
Weight	approx. 4.5 kg	approx. 9 kg
Dimensions	see Chapter 11 Dimensional drawings	
Vibration fatigue limit	acc. to IEC 68 part 2-6, table 2c, frequency range 10...150 Hz, amplitude 0.35 mm or 5 g single impact IEC 68 part 2-27, table 2, 15 g/11 ms permanent vibration IEC 68 part 2-29, 10 g/16 ms Shock absorbers are recommended for heavy vibration and impact demands (e.g. AGV applications).	

Table 13-1: Technical data

14 Order numbers

Laser scanners, indoor (blue housing, RAL 5012)	Order no.
LMS 200-30106	1015850
LMS 220-30106	1015945
Laser scanners, outdoor (grey housing, RAL 7032)	Order no.
LMS 211-30206	1018023
LMS 221-30206	1018022
LMS 291-S05	1018028
LMS 211-S07 (relay outputs)	1018966
LMS 221-S07 (relay outputs)	1018965
Laser scanners (housing not lacquered)	Order no.
LMS 209-S02 (technical data as LMS 200)	1016414
LMS 200/LMS 291 accessories	
Mounting set 1	2015623
Mounting set 2	2015624
Mounting set 3	2015625
Fine adjustment mounting set	2002925
3rd axis for fine adjustment	2020926
Connection set 1, power supply and interface plugs (without cables)	2018963
Connection set 2, power supply and RS 232/RS 422-interface plugs (5 m cable each) prepared for RS 422	2018964
Connection set 3, power supply and RS 232/RS 422-interface plugs (10 m cable each) prepared for RS 422	2018965
Interface cable 1, connection LMS – PC for setting parameters/configuration RS 232, cable length 3 m	2016401
Interface cable 2, connection LMS – PC for setting parameters/configuration RS 232, cable length 5 m	2016402
Heating plate	2019522
LMS 211/LMS 220/LMS 221 accessories	
Mounting set (wall mounting)	2018303
Mast attachment set (mounting set required)	2018304
Tightening strap (per metre)	5306222
Tightening strap lock	5306221
Dust prevention shield (for LMS 211 only)	2017722
Dust prevention shield with motor flap (for LMS 211 only)	2018306
Weather protection (for LMS 220/221)	4034559
Interface cable, connection LMS – PC for setting parameters/configuration RS 232/422, cable length 5 m	2019561
Purging air fan	on request
General accessories	
Data cable, weatherproof, 2x2 twisted pair, per metre	6011103
High-speed serial PC card, 2x RS 422, 500 kbaud, ISA bus	6011807
Mains adapter 24 V DC/2,5 A (suitable for parallel operation)	6010361
Mains adapter 24 V DC/4 A (suitable for parallel operation)	6010362
Mains adapter 24 V DC/10 A	6011156
Scanfinder (alignment aid)	6020756
Synchronisation connection box	2021520

Table 14-1: Order numbers (continued on next page)

continued Table 14-1: Order numbers

Documentation (included in delivery LMS)	Order no.
Technical Description (German)	8008969
Technical Description (English)	8008970
User-Software Operating Instructions with software on 3,5"-diskette	
(DE), German	2018307
(EN), English	2018311
Telegram listing (DE), German (pdf file in user software)	–
Telegram listing (EN), English (pdf file in user software)	–
LMS 200/LMS 291 spare parts	Order no.
Front window	2016408
LMS 211/LMS 220/LMS 221 spare parts	Order no.
Drying agent cartridge	5306179
Device plug with housing	2018301
16-pin plug insert	6004379
System application/expansions	Order no.
LMI 400 (area monitoring expansion)	1013863
LMI 101 (measuring bulk materials)	7044000
LMI 200 evaluation and control unit for measurement applications	1016761
Customer-specific evaluations	on request

Table 14-1 (cont.): Order numbers

15 Glossary of terms

Monitored fields	Freely programmable zones (spaces); if an object is in a particular zone a switching signal is given out.
Field set	Consists of 2 or 3 individually definable fields (field A, B or field A, B, C). 2 field sets can be stored in the LMS, up to 4 field sets in the LMI 400
Field set switching	Change between different field sets. Field set 1 or 2 is active in the LMS; in the LMI 400 two field sets can be activated simultaneously. Switching takes place at the reset input (24 V DC, static or SW telegram) for the LMS, and via separate control inputs for the LMI (24 V DC, static or SW telegram).
Subtractive fields	Allows a zone to be monitored that is the "space remaining" when field B is deducted from field A.
Restart, automatic	The particular switching output of a field is re-activated immediately after the field is freed of infringement.
Restart, after delay	The particular switching output of a field is re-activated a defined period of time after the field is freed of infringement.
Restart, with button	The particular switching output of a field is re-activated when an external button is pressed after the field is freed of infringement.
Temporary field	A field form can be defined and activated by external data information, transfer time about 200 ms (temporary because when the power supply is removed the field is lost).
Dynamic field	Only with LMI 400; fields can be automatically changed in form and size depending on a shaft encoder input (e.g. speed in an AGV application).
Blanking	Is set in cm as the so-called blanking factor. The blanking factor defines the minimum object size that can lead to registration at the switching outputs. Note: blanking is only possible in conjunction with scan-oriented evaluation (not in conjunction with pixel-oriented evaluation).
Field evaluation	To prevent erroneous switching caused by particles, etc. fields are evaluated using various processes (scan-oriented or pixel-oriented, always in conjunction with multiple reading).
Scan-oriented evaluation	With scan-oriented evaluation a field infringement at any particular location is stored and verified using multiple readings. If subsequent scans register further infringements at this particular location the particular field switching output is activated after the number of multiple readings defined have registered positive infringement.
Pixel-oriented evaluation	In contrast to scan-oriented evaluation, with pixel-oriented evaluation every single beam of the scanner is evaluated. This method is best suited for increasing availability in rain and snow.
Contour as reference	This function monitors the surrounding area of a monitored field. In other words, an object's existence (e.g. house wall) is constantly being verified. If this contour ceased to be registered the corresponding switching output would become active even without any infringement of the field. The range of validity of the reference contour can be set as desired. This function can also be used to prevent sabotage.

SICK

EC Declaration of Conformity

In Compliance with the EC Directive on Electromagnetic Compatibility 89/336/EEC

We hereby declare that the devices (see page 2)

of the product family LMS2...-.....

comply with the basic requirements of the EC Directive specified under Point 1. If an item of equipment listed overleaf is modified without our approval then this declaration loses its validity for this equipment.

We employ a quality system certified by the DQS (German Quality Assurance Society), No. 19 462-01, as per ISO 9001 and have therefore observed the regulations in accordance with module H as well as the following EC directives and EN standards during development and production:

1. EC directives	EC EMC directive 89/336/EEC as per 92/31/EEC, 93/68/EEC, 93/465/EEC		
2. Harmonized standards and preliminary standards used	EN 50081-1	Emitted interference, residential commercial and light industry	Ed. 92-01
	EN 50082-2	Immunity, industry	Ed. 95-03

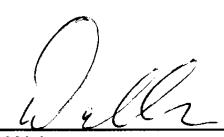
Conformance of a type sample belonging to the above-mentioned product family with the regulations from the listed EC directives has been certified by:

Test authority

} The tests were carried out and documented on our own responsibility.

Reute, 1998-08-16


i. V. Pierenkemper
(Manager Development Division Auto Ident)


i. V. Walter
(Manager Production Division Auto Ident)

The declaration certifies conformance with the listed directives, but does not guarantee product characteristics.

The safety instructions contained in the product documentation must be observed.

Mat. No.: 9 055 675

Page 3, engl.

Update no.: see page 2

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Fig. 15-1: Reproduction of the EC Declaration of Conformity, page 1 (reduced in size)

The EC Declaration of Conformity No. 9055675 is valid for the following types of the product family LMS:

Type	Id.-No.
LMS200-30106	1015850
LMS210-20201	1013859
LMS210-20202	1013856
LMS210-20204	1013860
LMS210-30206	1017812
LMS211-20201	1013853
LMS211-20202	1013854
LMS211-20204	1013855
LMS211-30206	1018023
LMS220-20203	1013865
LMS220-30106	1015945
LMS220-30206	1017811
LMS221-20203	1015833
LMS221-30206	1018022
LMS290-S01	1016024
LMS291-S01	1016078
LMS209-S02	1016414
LMS299-S03	1016829
LMS200-S04	1016828
LMS290-S05	1018027
LMS291-S05	1018028
LMS219-S06	1018761
LMS229-S06	1018764
LMS211-S07	1018966
LMS221-S07	1018965

end of list -

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Update no.: K438

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Fig. 15-2: Reproduction of the EC Declaration of Conformity, page 2 (reduced in size)



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